Patient Monitoring With the Propaq

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ECG Monitoring

ntended Use

The Propaq can be used in many rugged environments, including aircraft, field hospitals, and ambulances. In the hospital, the Propaq can be used in ER, OR, PACU, Cath Lab, Endoscopy, Labor & Delivery, for interdepartment patient transport, and in many other departments where a vital signs monitor is necessary.

The Propaq will not be damaged by use in concert with procedures using electrosurgical machines and defibrillators. However, the ECG channel does not contain electrosurgical interference suppression (ESIS) and may display noise artifact on the ECG trace while an electrosurgical device is in use. Special precautions must be observed when using the Propaq (or any monitoring device) with electrosurgical devices.

WARNING

High-intensity radio frequency (RF) energy from external sources, such as an improperly grounded electrosurgical unit, can induce heat into electrodes and cables which can cause burns on the patient. Reading errors and damage to equipment may also result. This hazard can be reduced by (1) operating the monitor on battery power only, (2) selecting ECG electrode attachment points remote from the expected RF paths, and (3) using electrosurgical pads with the largest practical contact area.

The Propaq is not intended to be used for direct cardiac application or on neonates.

Using the analog output connector on the side of the Propaq, you can send the ECG and pressure waveform signals to an external device, such as a strip-chart recorder. Connection between the Propaq and another device must be performed in accordance with the safety recommendations of AAMI. See Appendix B for more information about the Analog Output Connector and the Analog Output Cable available from Protocol Systems.

The Propaq is intended to be used only with accessories provided or recommended by Protocol Systems. Use of other accessories may cause damage to the Propaq or indicate inaccurate patient information.

CAUTION

For accurate ECG information and protection against noise and other interference, use only ECG electrodes and cables specified or supplied by Protocol Systems, and follow recommended application procedures. ECG electrodes must be of similar metal to prevent excessive polarization. See Appendix C for part numbers and ordering information of ECG cables and other accessories.

The Propaq is intended for ECG monitoring of leads I, II, III, and Marriot configuration 1 (MCL1). The Propaq 100 series is not intended for *diagnostic* ECG monitoring.

agnostic—*the lity of an ECG nitor to display y detailed veforms ough extended nitoring ndwidth. The paq is not a gnostic nit[illegible]y AAMI*

The Propaq can be used on patients with pacemakers. However, as with many monitoring devices, pacemaker patients should be kept under close or constant observation. The Association for the Advancement of Medical Instrumentation (AAMI) cautions that "rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. *Do not rely entirely upon rate meter alarms.* Keep pacemaker patients under close observation." See ECG specifications in Appendix B for disclosures of the Propaq's pacemaker pulse rejection capability. For more information on using the Propaq with pacemaker patients, see *Using the Propaq With Pacemaker Patients* later in this section.

Preparation

Preparing for ECG monitoring with the Propaq requires you to prepare the monitor, prepare the patient, set up the ECG channel, and then set the ECG alarms.

☞ **Preparing the Monitor.** Inspect the ECG cable for wear, breakage, or fraying. Replace it if the cable shows signs of any of these. Plug the ECG cable into the ECG connector on the Propaq's left side panel, and plug the lead wires into the ECG cable.

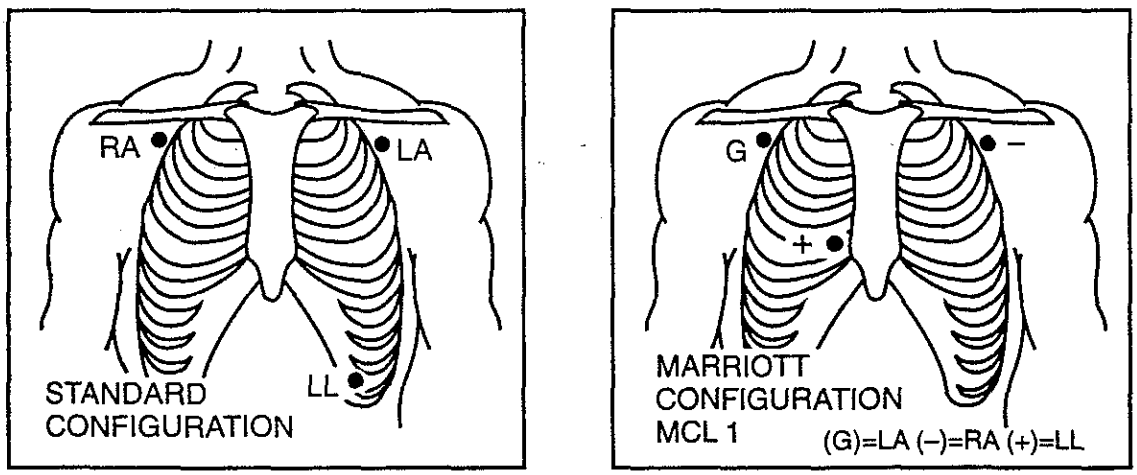
☞ Press the monitor's OFF (STANDBY)/ON switch to turn it on.

☞ **Preparing the Patient.** Thoroughly clean the skin areas where the electrodes will be attached. Attach the lead wires to the electrodes before applying them to the patient.

NOTE

Most electrodes are for single use only and should be used according to the manufacturer's instructions.

- If you are using pre-gelled electrodes, use only electrodes that have not expired. Make sure there is a generous amount of gel in the electrode and that it has not dried.
- If you are using non-gelled electrodes, apply a 1/4 to 1/2 inch mound of gel over the electrode contact area.
- Apply the electrodes to the patient in either the standard lead configuration or the Modified Chest Lead, MCL1, as shown in the figure below.
- Support the ECG cable so it does not stress the electrode wires, electrode wire/ECG cable connectors, or electrodes.
- If an electrosurgical unit is going to be used, place the ECG cable and electrode wires so that interference will be minimal. Operating the monitor on battery power only will help minimize interference.



Apply the electrodes in the standard lead configuration for monitoring leads I, II, or III; or in the MCL1 configuration.

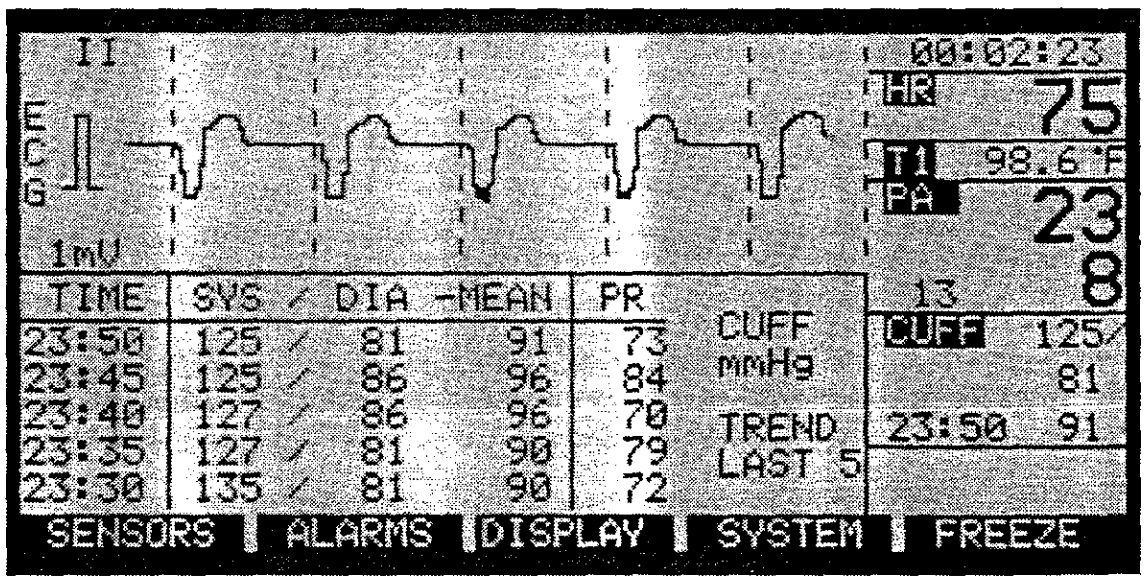
By now there should be some kind of ECG waveform displayed on the monitor. It may exhibit noise or pacer indications (dotted vertical lines), but the waveform should be nearly centered in the display area and sweep from left to right across the display. A heart rate should also be displayed to the right of the waveform. Depending on how the Propaq was *programmed* (see Chapter 1), a beep tone may occur with each detected QRS event. The figure below is a typical display.

Program—*the settings the Propaq automatically assumes when it is first turned on. You program the Propaq using the PROGRAM function in the System Menu.*

☞ If there is no waveform, check the electrodes, the electrode wires, the ECG cable, and the monitor for possible lead fault.

☞ **Setting Up the ECG Channel.** Press SENSORS and then ECG to set the ECG parameters: mm/sec, LEAD, SIZE, ♥TONE, FILTER, and PACER. See *How ECG is Displayed* below for more information on each of these functions. If the patient being monitored has a pacemaker, you may want to turn on the Pacer function. See *Using the Propaq With Pacemaker Patients* below. If the ECG waveform exhibits noise due to ac mains interference, you may want to activate the ac mains filter as described in *Using the Filter To Better Display A Waveform.*

☞ **Setting ECG Alarms.** See Chapter 3 for information on setting alarm limits. Set the alarm limits according to your hospital's protocols.



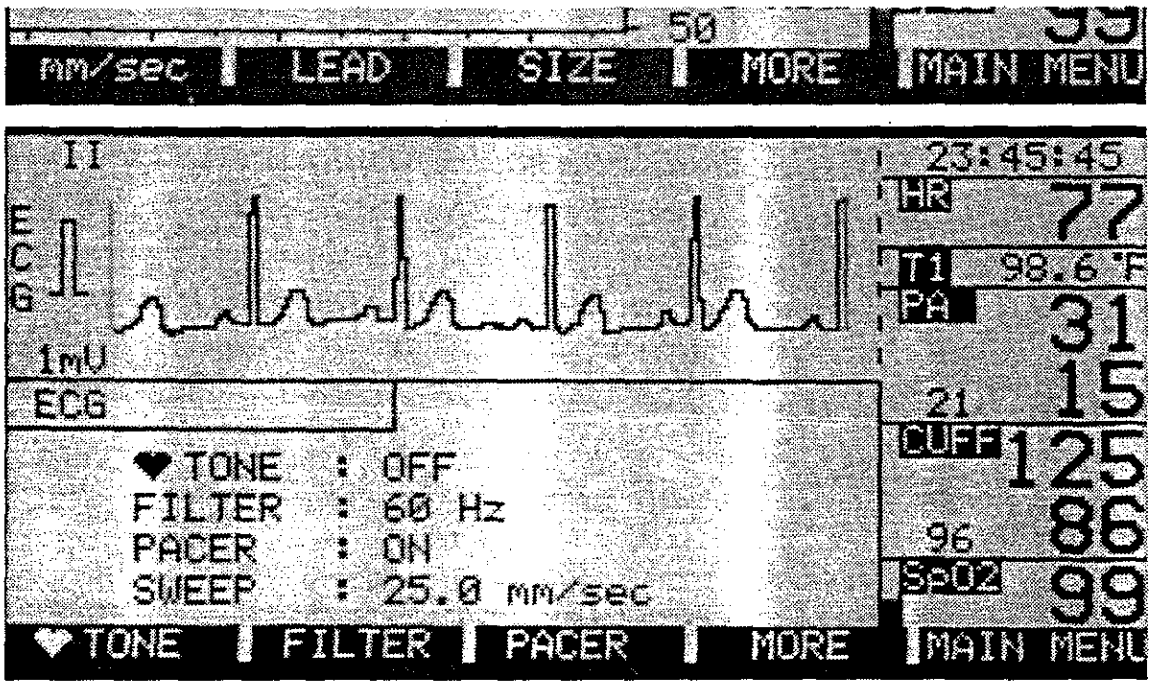
A typical ECG waveform display may include pacer indicators as shown here. The heart rate is shown to the right of the waveform.

ow ECG is Displayed

Monitoring the electrocardiogram (ECG) provides information on the electrical activity of the heart, which is displayed as the ECG waveform in the top part of the waveform display area. Up to two other waveforms can be shown below ECG, but because of the critical nature of monitoring ECG, it is always shown on top. In addition, the ECG waveform is the only waveform that *cannot* be turned off using the Wave Select Menu described in Chapter 1.

Patient movement and other artifact might cause the ECG waveform to move up and down on the display. Most artifact such as this is automatically detected and adjusted so that the ECG waveform always remains centered in the ECG waveform window. However, severe artifact may cause the waveform to jump off the display. In such situations, the Propaq will always automatically reposition the waveform in just a few seconds so you can see it again.

The Propaq provides several functions that affect the ECG waveform display and the tone that sounds with each detected heart beat. The buttons that affect these functions are the LEAD, SIZE, mm/sec, and ♥TONE buttons. These buttons are all found in the ECG Menus you select by pressing (starting at the Main Menu) SENSORS and then ECG. When you press the MORE button in the first ECG Menu, a status window appears showing you the current ECG settings. A typical ECG status window is shown below.



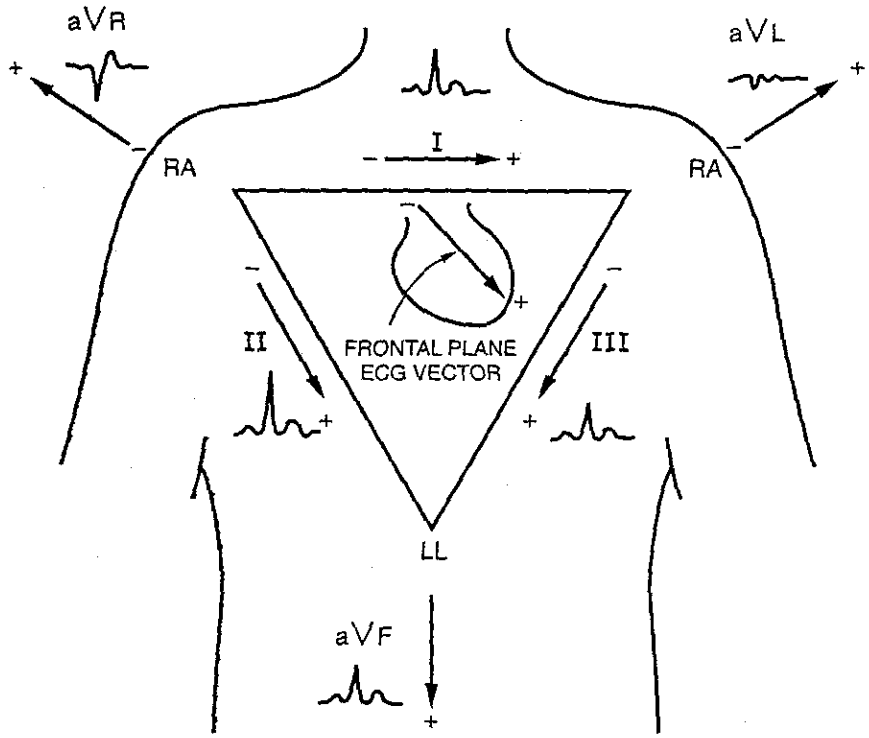
LEAD. The electrical signal generated by the heart can be detected along different axes through the heart. Selection of which axis is monitored is done using the LEAD button in the ECG Menu. The Propaq can monitor leads I, II, and III, plus the modified chest lead (MCL1), also called the Marriot Configuration. The figures on the following page show these axes. Lead II is typically monitored in clinical applications. Therefore, the Propaq's normal, factory-programmed lead setting is Lead II. (See Chapter 1 for information on Propaq factory settings.)

The selected lead is indicated in the upper left corner of the display. If at any time after the Propaq begins displaying an ECG waveform, an ECG electrode becomes disconnected or disrupted so that the Propaq cannot receive the ECG signal, it alerts you through an equipment alarm. The alarm tone sounds and the disconnected electrode is indicated on the display.

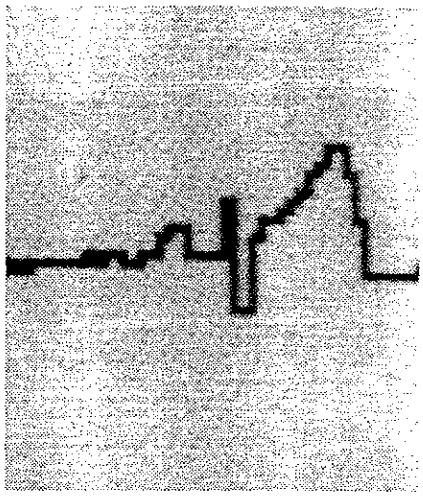
SIZE. The ECG waveform can vary in size depending on the strength of the heart signal and how well the electrodes detect the heart's electrical impulses. To accommodate varying signal strengths, the Propaq allows you to adjust the size of the ECG waveform on the screen. The SIZE function "increases" and "decreases" the ECG waveform size by simply pressing the SIZE button. There are five waveform size settings. Each time you press the button, the waveform size approximately doubles in height. When you reach the largest waveform size, the next press displays the smallest size.

A 1 cm. reference pulse is always displayed to the left of the ECG waveform. Below the pulse is the size indicator, which changes each time you press the SIZE button. You use the pulse and size value as a reference to determine the electrical amplitude of the heart signal. If the size value is 1 mV, a QRS event on the ECG signal that is the same height as the pulse is a 1 mV QRS event.

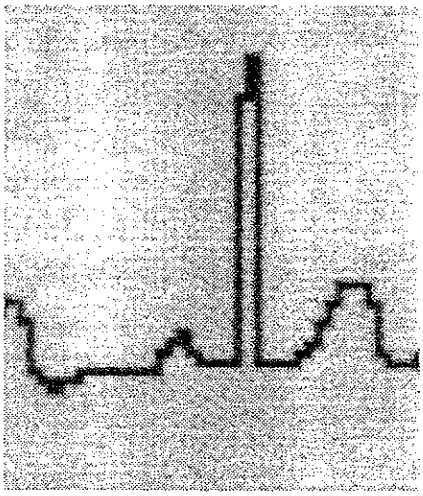
mm/sec. All waveforms are drawn across the display from left to right. The oldest waveform information is replaced by the newest information, with an invisible erase area separating the two. The rate at which the waveforms are drawn is set by the mm/sec button. The Propaq can draw the waveforms at three speeds: 12.5 mm/sec, 25 mm/sec, and 50 mm/sec. At faster speeds, the waveforms are expanded. The fastest speed gives you the most detail of the ECG and other waveforms. Since the speed affects all waveforms, the mm/sec function is also found in one of the Display Menus.



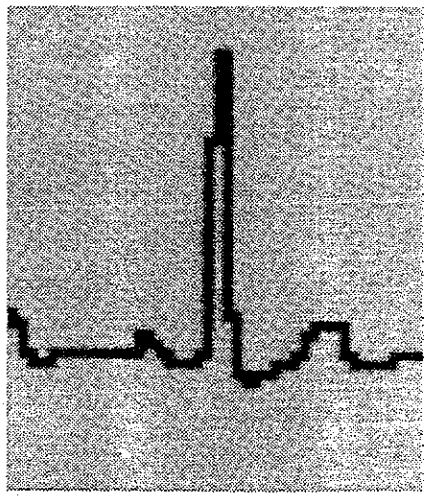
As the heart signal is propagated through the body, it can be monitored along several axes. The Propaq can detect the signal along three of these axes: I, II, and III. The figures to the right show Propaq waveforms for each of these leads according to the selected lead and assuming proper electrode placement.



Lead I



Lead II



Lead III

♥TONE. Each time the Propaq detects the occurrence of a QRS event, it makes a short beep. This is the Propaq's heart tone. You can turn off the heart tone or set it to one of three volumes—LOW, MEDIUM, or HIGH—using the ♥TONE button. Earlier Propaqs do not include a medium setting.

The ♥TONE sounds for each QRS event, or, if the heart rate source is a pressure channel, or SpO_2 for each detection of a heart beat. Because the heart tone does not depend on just the ECG channel, the ♥TONE button is also found in one of the Display Menus.

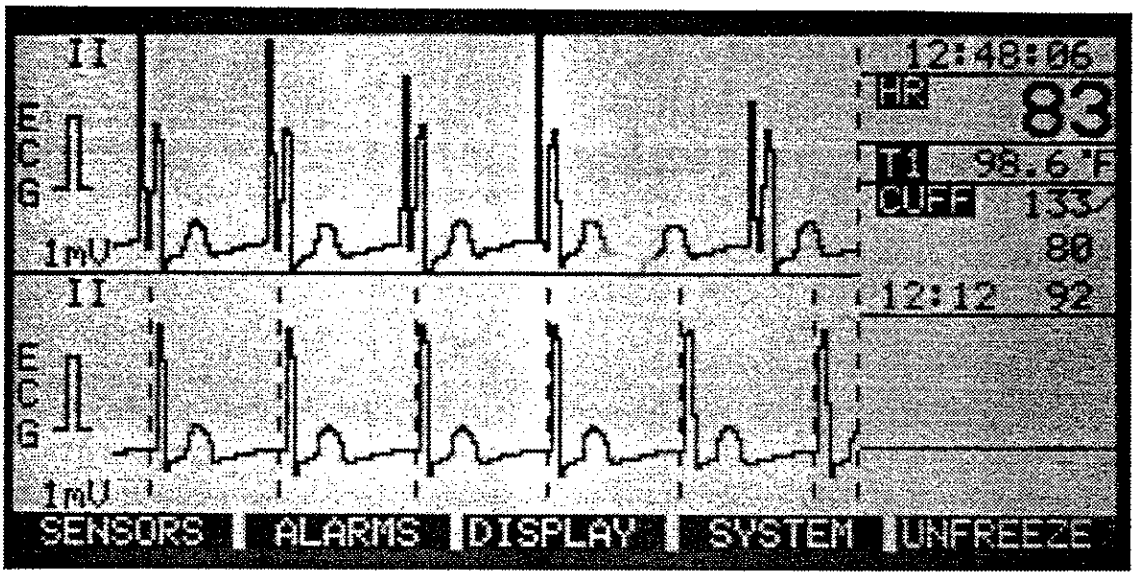
If SpO_2 is monitored (described later in this chapter), the heart tone is produced by the speaker in the SpO_2 option. The pitch of the tone varies with the SpO_2 value. If SpO_2 is not monitored, the heart tone is produced by the speaker in the Propaq.

Using the Propaq With Pacemaker Patients

If the patient being monitored has a pacemaker, the Propaq detects and can indicate the occurrence of pacemaker signals. With the Propaq, pacemaker signals are not counted as heart beats as long as the pacemaker signal meets the pulse amplitude and pulse width specifications listed in the Specifications of Appendix B. Most pacemakers meet these specifications. However, AAMI cautions that all pacemaker patients be kept under close observation. AAMI further states that "rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or some arrhythmias. Do not rely entirely upon rate meter alarms."

On the Propaq display, detected pacemaker signals appear as vertical dashed lines. Whether the pacemaker is atrial, ventricular, or both, the vertical line appears as the pacemaker signal occurs as shown in the figures on the following page.

Some pacemakers conduct signals that exhibit "overshoot" or "undershoot" characteristics, and the signal may be detected as a QRS event. You can see this condition on the Propaq display by checking the ECG waveform just after the pacemaker indicator line. If the waveform looks like it has a "hole" in it, the pacemaker signal is not being accurately filtered. This characteristic could result in paced beats being counted as a heart beat. Keep patients with this type of pacemaker under very close observation.



A typical pacemaker signal is detected by the Propaq and displayed as a dashed line in the ECG waveform. Pacemaker signals that cannot be recognized can be counted as a heart beat. All pacemaker patients should be kept under close observation.

Noise on the ECG signal may be detected as pacer signals, causing the pacer indicator to appear on the display. If you don't need to indicate pacemaker signals, you may want to turn off the pacemaker indicator for a better display of the ECG waveform.

To Turn On and Off the Pacemaker Indicator: To turn on or off the pacemaker indicator, you press the PACER button in the ECG Menu. The status of PACER is shown in the ECG status window above the menu. When PACER is OFF, pacemaker signals are not indicated on the display, and the line separating the heart rate value from the ECG window is a solid line. When PACER is ON, pacemaker signals are indicated on the display as dashed lines, and the line separating the heart rate value from the ECG window is a dashed line instead of a solid line. If paced beats are not indicated on the display, you can tell whether PACER is on or off by looking at the line separating the heart rate value from the ECG window.

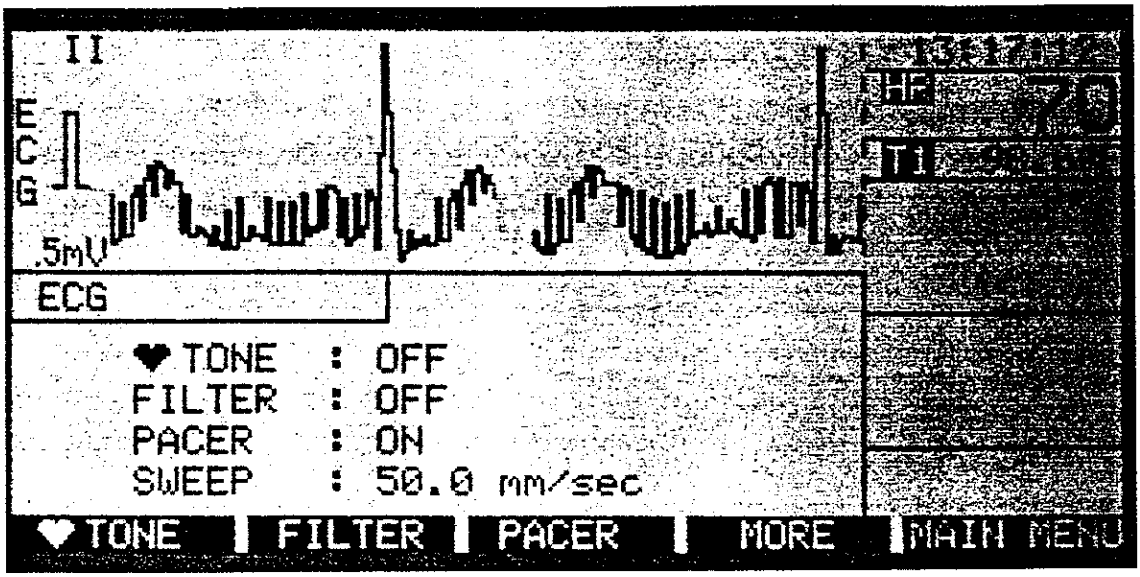
Using the Filter to Better Display a Waveform

Within the hospital, the ac mains emit electrical signals from many sources, including lights, ac power cords, electrical equipment, and other devices that use the mains for power. Any medical device might pick up this signal just as a TV antenna picks up television signals. Unfortunately, this signal is unwanted in such devices since it can affect the display of important information like the ECG signal. Therefore, the Propaq includes a feature that filters out the mains signal, producing a much clearer ECG waveform.

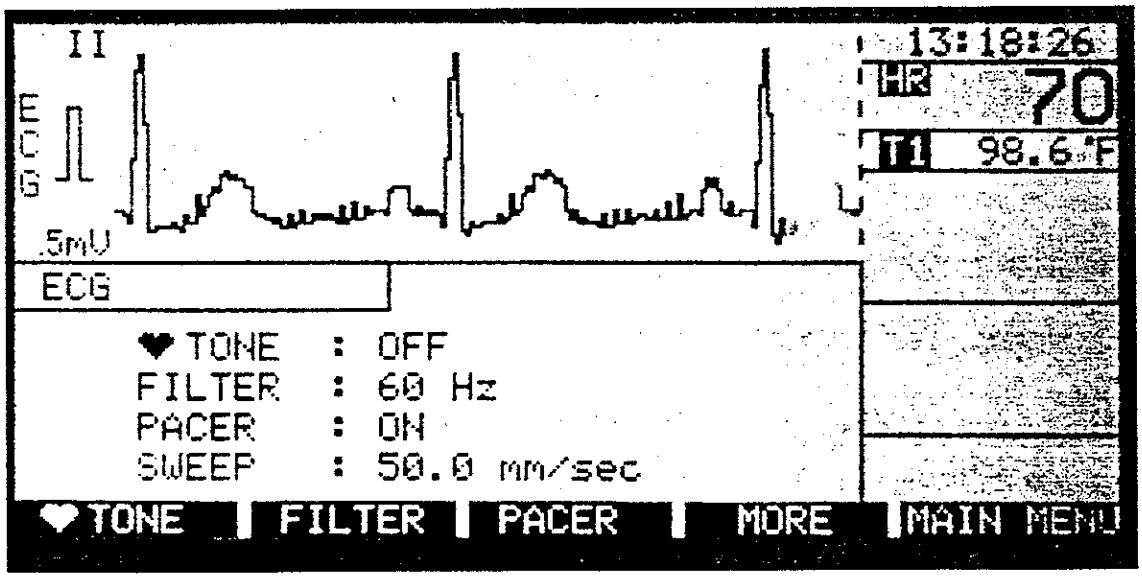
You can turn off or on this filter using the FILTER button in the ECG Menu. FILTER status is indicated in the ECG status window when the menu is displayed.

With FILTER turned OFF, mains noise may show up on the display as shown in the figure on the next page. With FILTER turned ON, this noise is removed.

When setting the filter, you should set it to the ac mains frequency of your hospital. This is typically 60 Hz in North America. Other countries typically use 50 Hz, and the filter should be set to that frequency.

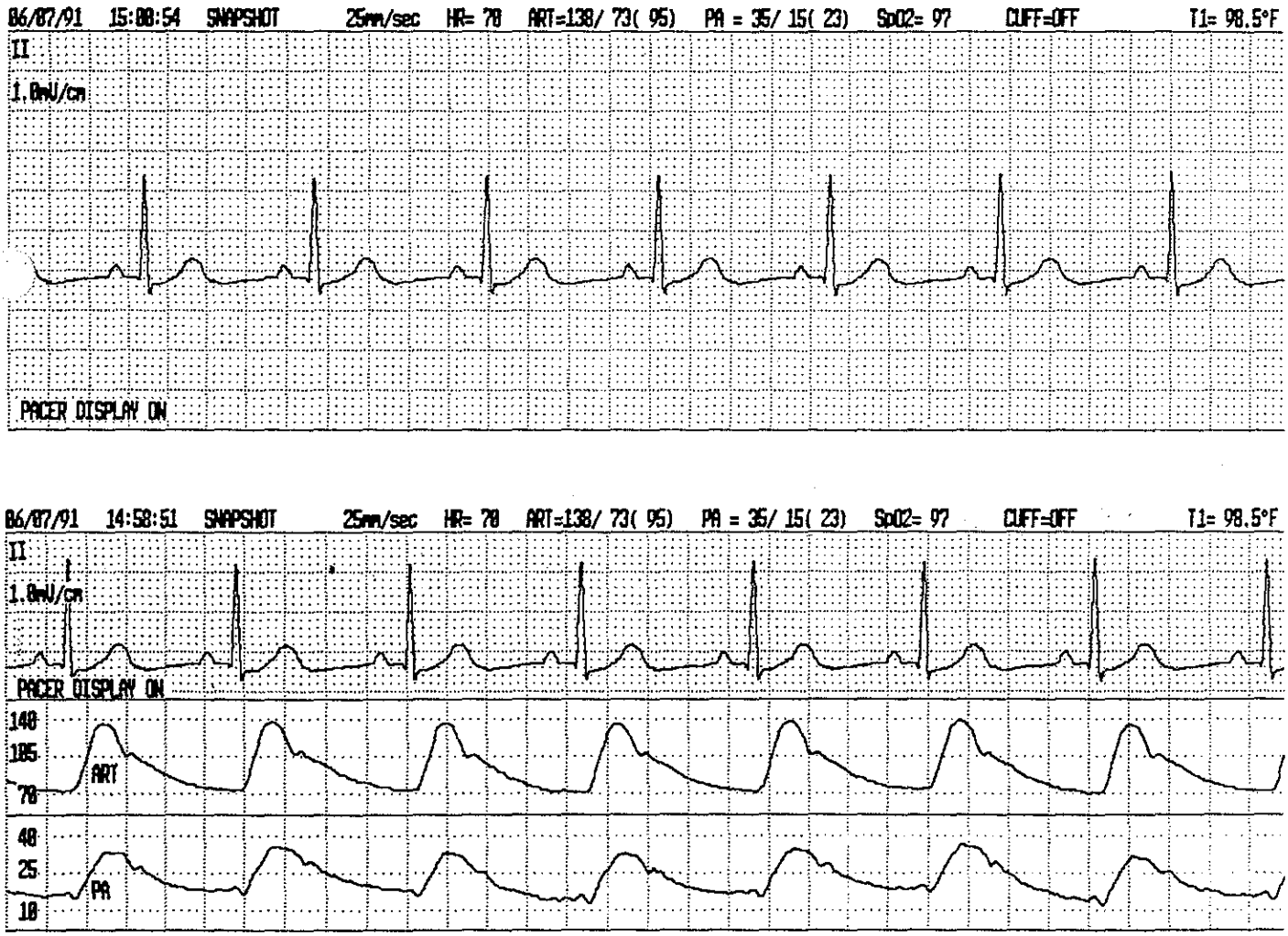


Ac mains noise can be picked up and displayed on the Propaq, resulting in a noisy ECG waveform as shown in the figure above. With the filter turned on to the ac mains frequency, the ECG waveform is much clearer as shown in the figure below.



Printing the ECG Waveform

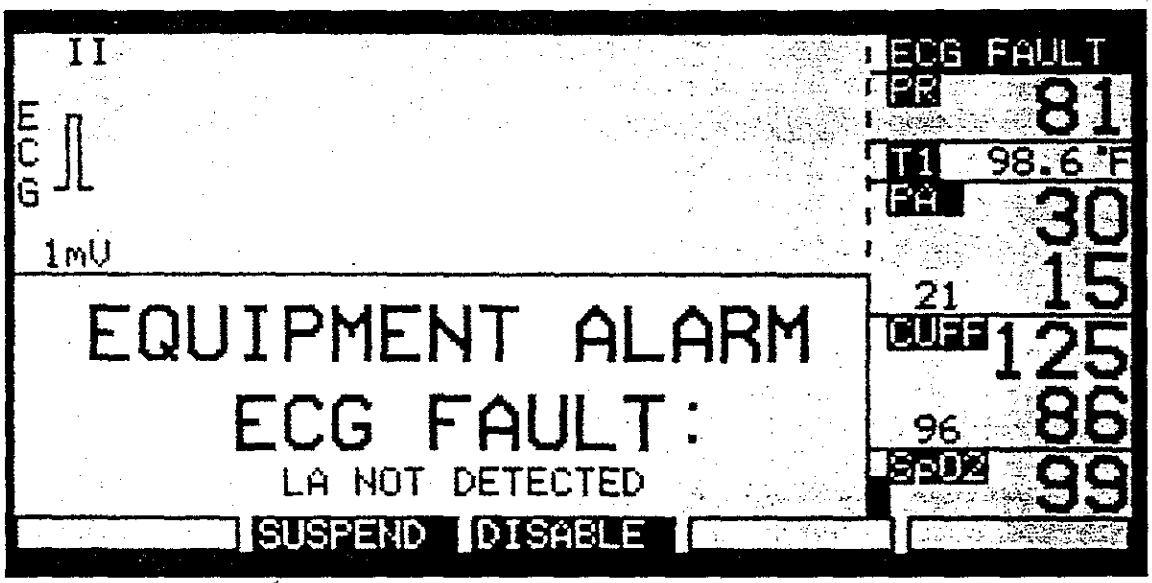
You can print the ECG waveform by pressing either the SNAPSHOT or START/STOP button on the printer when the ECG waveform is displayed on the monitor. ECG is printed on a grid with major divisions (dotted lines) every 5 mm and minor divisions (single dots) every 1 mm (see the figure below). If only ECG is monitored, the ECG waveform is printed by itself; it occupies the entire height of the printer paper. If one or two other waveforms are displayed on the monitor, all waveforms are printed, but only the ECG waveform is printed with 1 mm minor divisions. Waveforms are always printed at the print speed selected in the Printer Menu. (The display speed does not affect the printer speed.)



ECG waveforms can be printed alone or with other waveforms as determined by the sensors being monitored and the settings of the wave.select window. ECG waveforms are graduated with major (every 5 mm) and minor (every 1 mm) divisions.

ECG Messages

ECG messages indicate lead fault for one or more leads. All lead faults initiate an equipment alarm, causing the alarm tone to sound for one second at five second intervals. An equipment alarm window also appears indicating which lead or leads are faulty. See the section on equipment alarms in Chapter 3 for more information on equipment alarms and how to respond to them.



A lead failure results in an equipment alarm window indicating the faulty lead. Chapter 3 describes equipment alarms.

Invasive Pressure Monitoring

This section applies only to Propaq Models 104 & 106. If you don't have a 104 or 106, you can skip this section of Chapter 2.

Intended Use

The Propaq invasive pressure channel is intended for measuring arterial, venous, and intracranial pressures using invasive transducers with 5 µV/V/mmHg sensitivity. The Propaq can be used with many types of transducers, including non-disposable, disposable dome, and disposable. A list of compatible transducers can be found in Appendix C. Transducers must be applied according to your hospital's protocols and the transducer manufacturer's recommendations. Always refer to the transducer manufacturer's *Directions for Use* before applying the transducer.

The Propaq's invasive pressure range is from -30 to 300 mmHg, allowing you to use the Propaq for measuring arterial pressure, pulmonary artery pressure, central venous pressure, intracranial pressure, etc.

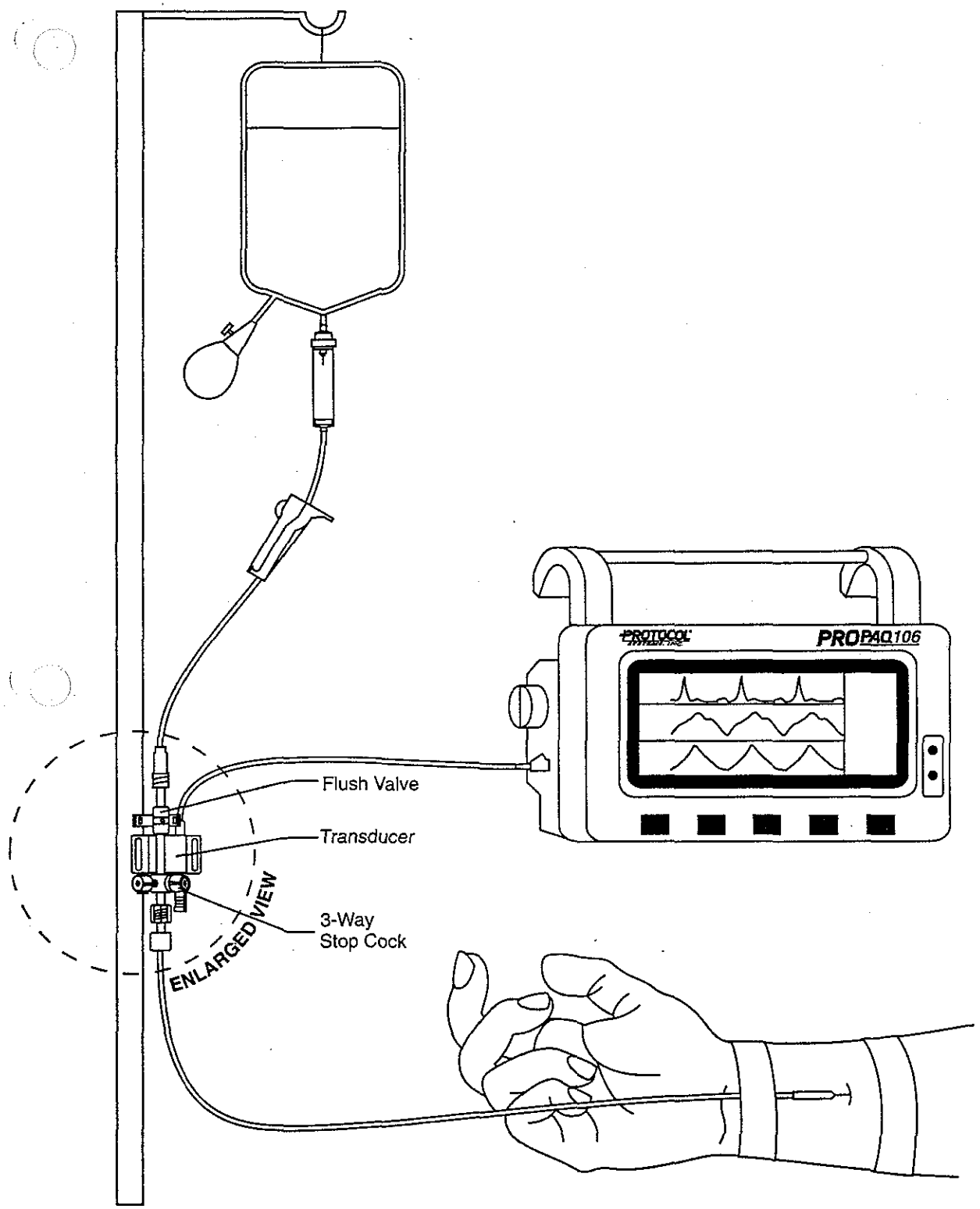
Preparation

Preparing for invasive pressure monitoring with the Propaq requires you to prepare the transducer, zero the transducer, set up the pressure channel, and set the invasive pressure alarm limits. The figure on the following page illustrates a typical Propaq invasive pressure channel preparation setup. Follow your hospital's protocols for your application.

☞ **Preparing the Transducer.** Inspect the transducer cable for wear, breakage, or fraying. Replace it if the cable shows signs of any of these. Replace the transducer dome if necessary.

☞ Apply the transducer according to your hospital's protocols.

☞ Connect the transducer to the transducer cable. Plug the transducer cable into an invasive pressure connector. The message NOT ZEROED immediately appears in the blood pressure numerics window for the invasive pressure channel being used.



he transducer must be one of those compatible with the Propaq as listed in Appendix C and must ave 5 µV/V/mmHg sensitivity. Apply the transducer according to your hospital protocols.

- **Zeroing the Transducer.** To zero the transducer, open the transducer's stopcock to atmospheric air. Allow a few seconds for the transducer to settle.

- Press the following Propaq buttons if you are using invasive pressure channel 1: SENSORS, then INV PRS, and then ZERO P1. If you are using pressure channel 2 (106 only), press the following buttons: SENSORS, then INV PRS, then MORE, and then ZERO P2. The word ZEROING appears in the numerics window.

- Wait for a tone to briefly sound and the word ZEROED to appear in the blood pressure numerics window.

- Close the transducer's stopcock.

- If the transducer will not zero, the words ZERO REJECTED will appear in the numerics window. Check that the transducer is open to atmospheric air and that it is properly connected to the Propaq. Then press CANCEL and try zeroing again. If the transducer still does not zero, you should try another transducer or another cable. For more information about zeroing, read *Important Information About Transducer Zeroing* below.

- **Setting up the Pressure Channel.** Press SENSORS and then INV PRS to set the invasive pressure channel functions: LABEL, FORMAT, RANGE, and RESCALE. See *How Invasive Pressure is Displayed* below for more information on these functions.

- **Setting the Invasive Pressure Alarms.** Set the alarm limits according to your hospital's protocols. See Chapter 3 for information on setting alarm limits.

portant Information About Transducer Zeroing

During zeroing, two important things are displayed: the ZERO P1 (or ZERO P2) button label changes to CANCEL to allow you to cancel the zeroing process if necessary, and zeroing messages appear in the blood pressure numerics window.

If the zero value is accepted, the word ZEROED appears in the blood pressure numerics window for a few seconds. The monitor then displays the pressure scale to the left of the waveform, and the pressure numerics appear. No pressure scale is displayed until the Propaq can establish a zero reference.

If the zero value is unacceptable, ZERO REJECTED appears in the pressure numerics window. This message remains until you press the CANCEL button. The pressure values and the scales are not displayed. They won't be displayed until an acceptable zero reference is established. If the transducer does not zero, check that the transducer is opened to atmospheric air and that it is properly connected to the Propaq. Then try zeroing again. Be sure you close the transducer's stopcock after zeroing. If you cannot zero the transducer, there might be a problem with the transducer or cable. You should try another transducer or cable.

ezeroing A Transducer

You can rezero a transducer at any time. If the transducer has already produced pressure readings, rezeroing provides a new zero reference for the Propaq. To rezero, follow these steps:

☞ Open the transducer stopcock to atmospheric air and press the ZERO button.

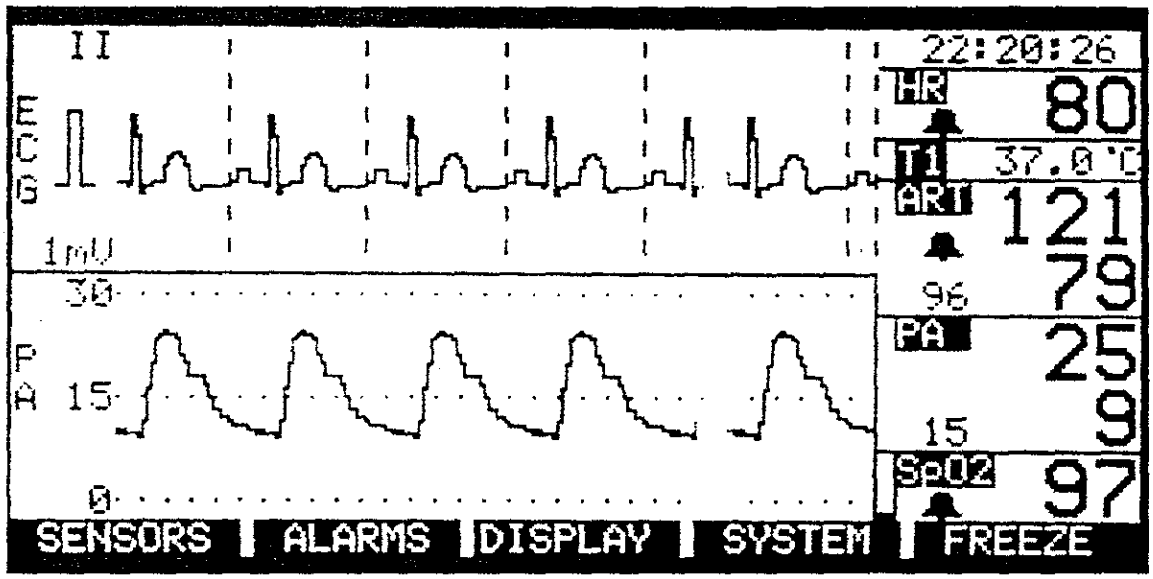
If the zero value is not accepted, the words ZERO REJECTED appear in the numerics window until you press the CANCEL button. *The Propaq continues to use the previous zero reference and displays the pressure values and waveforms based on that value.*

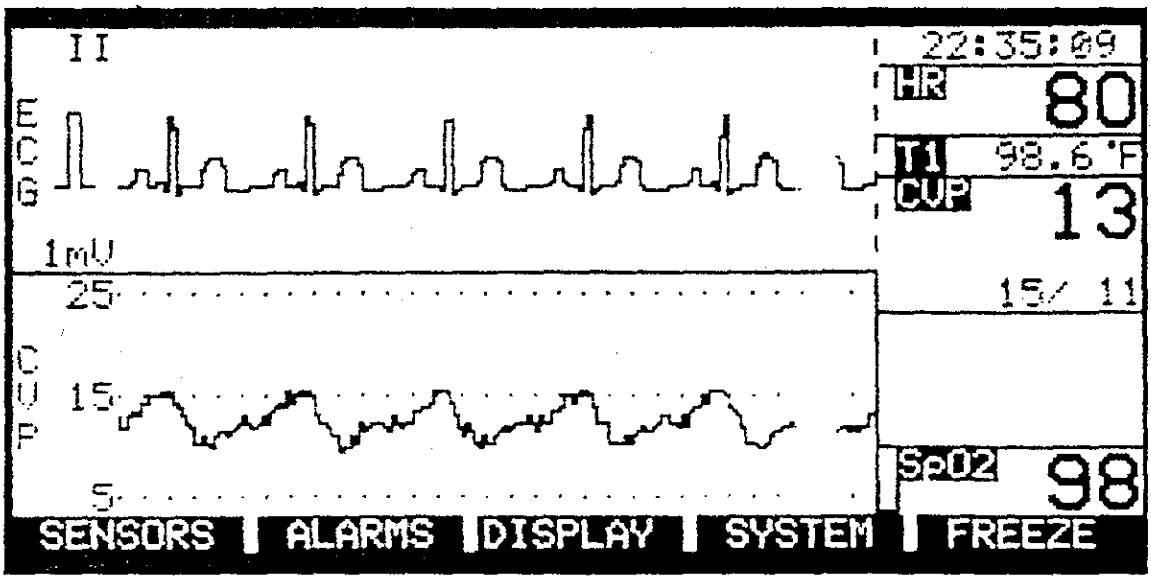
If the new zero value is accepted, the word ZEROED appears for a few seconds and a tone briefly sounds. After the zero message is removed, the new pressure values based on the new zero value are displayed, and the waveform is adjusted according to the new scale.

How Invasive Pressure is Displayed

From the invasive pressure transducer, the Propaq displays both a plethysmograph (pressure waveform) and pressure numeric values (systolic, diastolic, and mean). The waveform is displayed in a waveform window (if the waveform is turned on in the wave select window). The numerics are displayed in the blood pressure numerics windows.

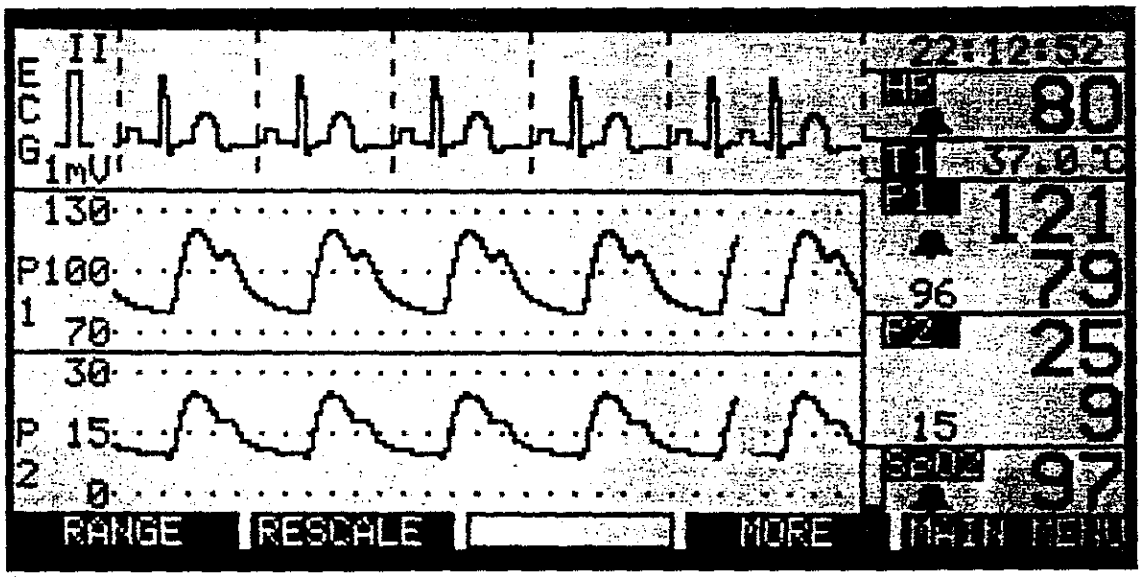
Along with the numerics, the Propaq allows you to identify the pressure measurement with a selectable label, and the numerics can be displayed in one of two formats as shown in the following figures.

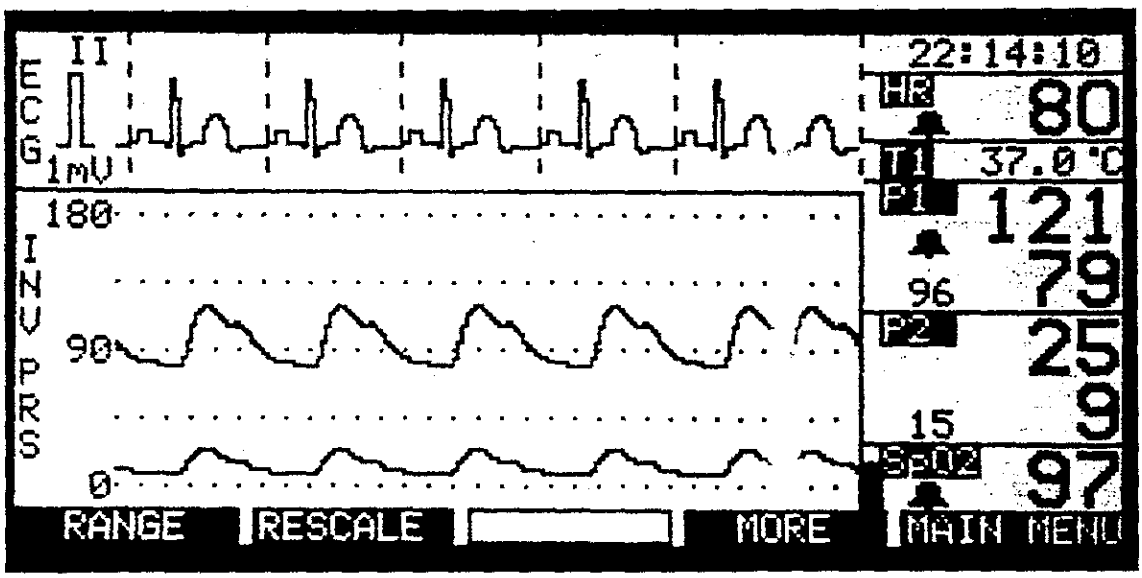




Invasive pressure waveforms can appear in several different ways on the display depending on what waveforms are turned on in the wave select window. The following figures show you different arrangements of the invasive pressure waveforms. In a typical application, the pressure waveforms are displayed to the left of the numerics below ECG.

Waveforms are displayed against selectable scales. You can independently display the waveforms each against its own scale that is automatically selected for best viewing of the waveform (RESCALE), or you can display both waveforms against one scale, which you can manually select (RANGE) .



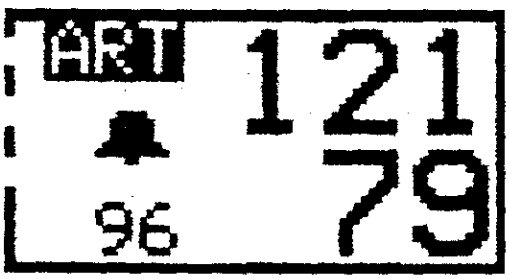


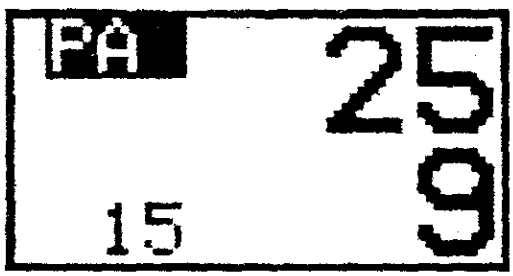
Channel Labels (LABEL Button). The Propaq allows you to select a pressure channel label so you can clearly identify the pressure measurement, such as arterial, pulmonary artery, or central venous pressure. The label appears in the blood pressure numerics window of the appropriate channel.

The Propaq provides several labels to choose from. You select the label by pressing the LABEL button in the Invasive Pressure Menu. The selectable labels are:

- ART—arterial
- PA—pulmonary artery
- CVP—central venous pressure
- ICP—intracranial pressure

You can still use the generic Propaq pressure label, P1 or P2, if you want. Just don't press the LABEL button after zeroing the transducer. If you press the LABEL button and get a label you didn't want, simply keep pressing the button until the desired label is displayed in the numerics window.

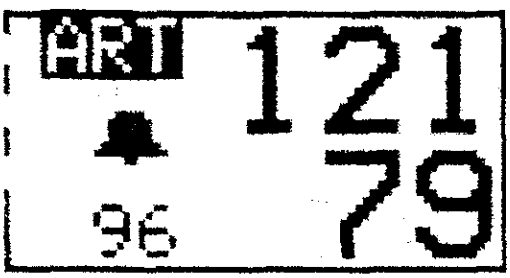


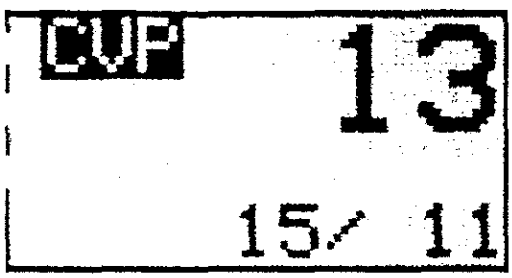


Numerics Formats (FORMAT Button). For some pressure measurements, such as arterial and pulmonary artery, the systolic and diastolic values are of prime importance. You want to clearly see these as they change. For other pressures, such as intra-cranial and central venous pressures, the mean pressure value may be the focus of attention.

The Propaq displays the invasive pressure values in two different sizes in the pressure numerics window, allowing you to select one of two formats in which you want the numerics displayed. When you label a pressure channel, the numerics are automatically displayed in the standard format for that particular label. However, by pressing the FORMAT button, you can select the alternate format. Thus, you can select which pressure value(s) are most prominently displayed.

The format is a very useful feature. For most hospital protocols and most clinicians the standard format for a desired label is the format the clinicians use. However, the alternate format is provided for those who want to change from the standard format.





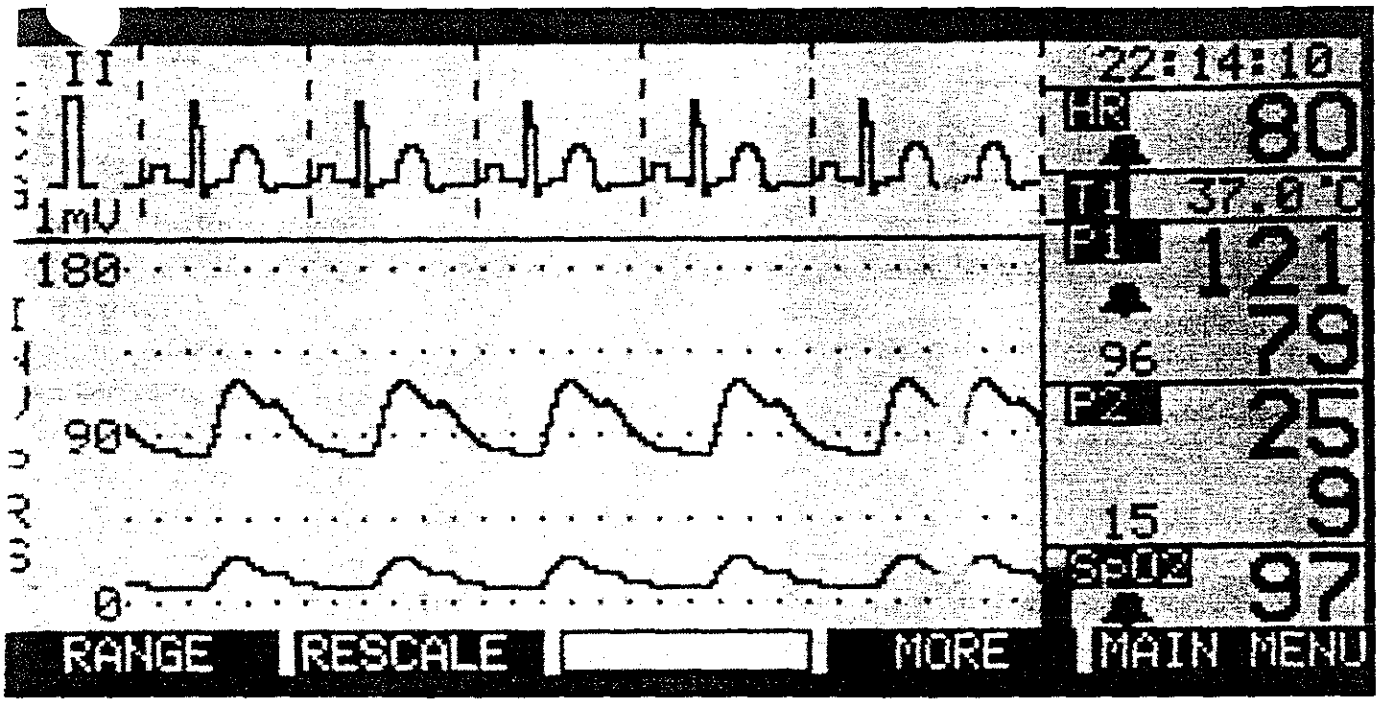
Waveform Scales (RANGE & RESCALE Buttons). Until you zero the transducer, the pressure waveform scales are not displayed. Once the zero reference has been established the scales automatically appear. Waveforms are displayed either together against one scale or independently against their own scales. The figures on the following page illustrate these displays.

For some procedures, you will want to display the waveform against one of the five Propaq pressure scales. You can display the waveform this way by pressing the RANGE button. With the Propaq 106, the RANGE button displays both pressure waveforms against this one scale. You can then see each waveform relative to the other. If the waveforms are displayed against independent scales (using the RESCALE button), the first time you press the RANGE button, the Propaq will change the display so both waveforms are against the same scale. You can then change the scale by pressing the RANGE button until the desired scale appears.

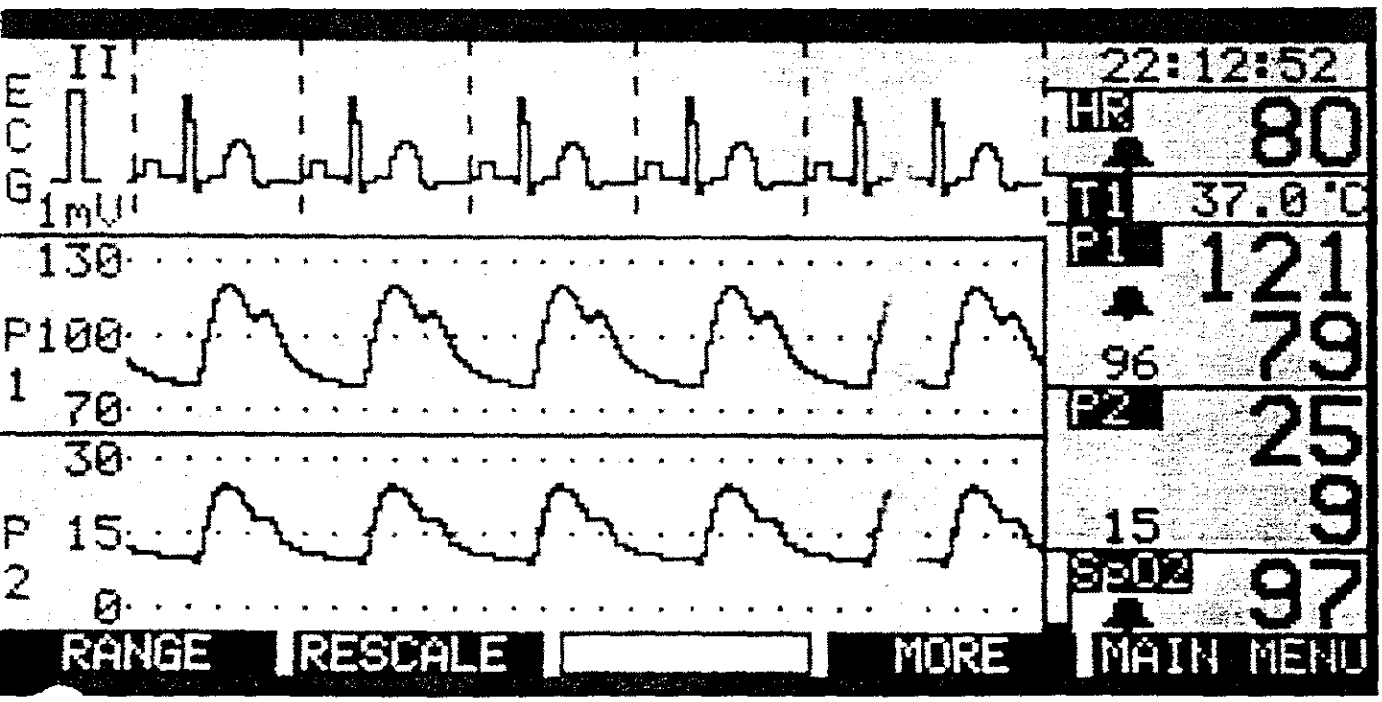
If two waveforms have a great difference in their pressures (such as arterial and pulmonary artery) and you set the pressure scale so the lower pressure waveform is large, the higher pressure waveform may not be visible since it is out of the range of the scale. To see both waveforms again, simply press the RANGE button until you get the desired scale.

For some procedures, you may want to see the largest possible view of a waveform without causing the waveform to be out of range of the scale. You can display the waveform this way by pressing the RESCALE button. Each time you press the RESCALE button, the Propaq examines the highest and lowest pressure levels of each pressure waveform and selects the best scale for viewing each waveform. If the pressure levels change and part or all of a waveform goes out of range of its scale, simply press RESCALE again to readjust the waveform scales.

On the Propaq 106, rescaling is especially helpful when you want to see the fine details of two pressure waveforms when one represents a much lower pressure than the other. Both scales are adjusted each time you press RESCALE.

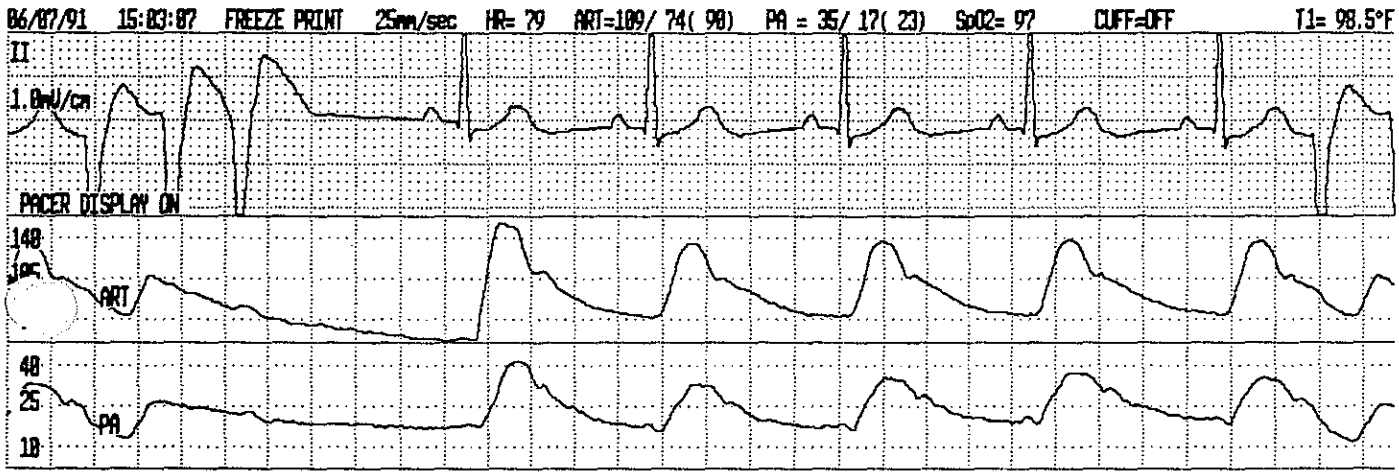


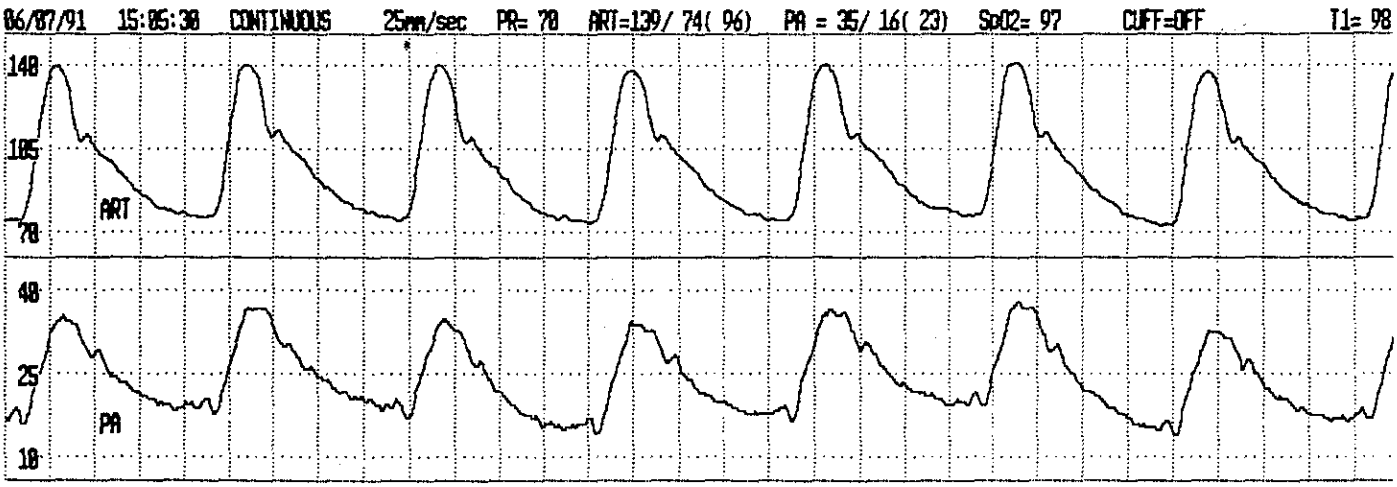
Waveform scales are automatically adjusted when you press the RANGE or RESCALE button. RANGE lets you select from one of five Propaq pressure scales. If two pressure waveforms are displayed, both are displayed against the same scale (figure above). RESCALE automatically adjusts each waveform scale for best viewing with its scale (figure below).



'nting a Pressure Waveform

You can print the pressure waveform(s) by pressing either the SNAPSHOT or START/STOP button on the printer when the waveform(s) are displayed on the monitor. Pressure waveform(s) are printed on a grid with major divisions (vertical dotted lines) every 5 mm, and the pressure scale grids are printed horizontally (see figure below). If only invasive pressure is monitored, the waveform(s) are printed by themselves across the paper. Waveforms are always printed at the print speed selected in the Printer Menu (see Chapter 1). (The display speed does not affect the printer speed.)





ropaq Invasive Pressure Messages

The invasive pressure channel can produce messages that appear in the numerics window, the time of day window, and the equipment alarm window. The figures on the following page illustrate these messages.

The following messages can appear in the *numerics window*. Each message is described below. (Px in the message represents the pressure label for the channel, such as ART, PA, P1, etc. The message can be for P1 or P2.)

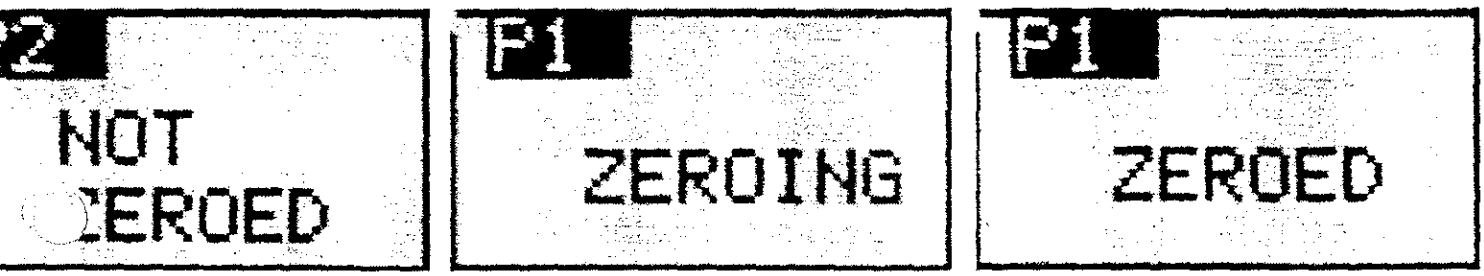
Px NOT ZEROED. This message appears the first time a transducer is connected to the monitor. It indicates that no zero reference has been established. The monitor displays the pressure waveform, but to protect against erroneous readings, the pressure waveform scale is not displayed.

Px ZEROING. This message briefly appears as the transducer is being zeroed.

Px ZEROED. This message appears after the zero value has been accepted. It remains for eight seconds and is replaced by the current pressure values. After zero acceptance, the pressure waveform scale appears.

Px ZERO REJECTED. This message appears after unsuccessfully attempting to acquire a zero reference value. The message remains until the **CANCEL** button is pressed.

Px CANCELED. This message appears after the CANCEL button is pressed and remains for eight seconds.



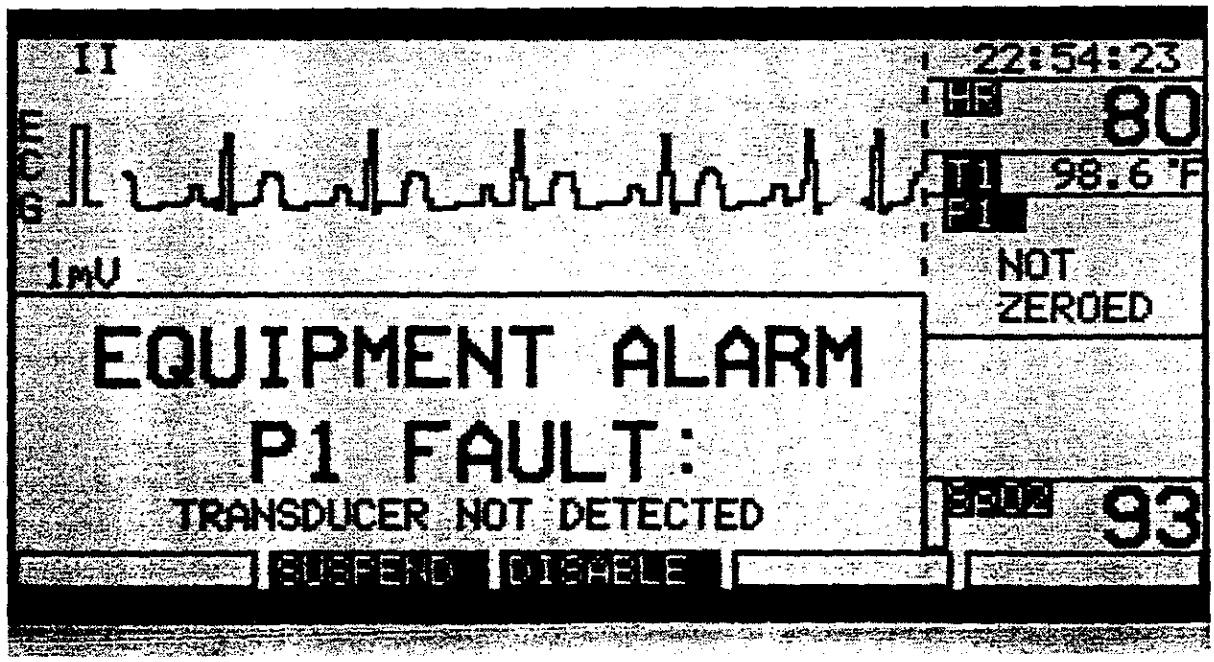
The following caution messages can appear in the ***time of day window*** above the heart rate.

P1 FAULT (P2 FAULT). One or both of these messages appear when a transducer fault is detected. An equipment alarm also occurs. (See the following equipment alarm messages.)

The following equipment messages can appear in an ***equipment alarm window.*** A caution message also appears in the time of day window.

TRANSDUCER NOT DETECTED. This message appears when the Propaq detects that a transducer connection is broken. The transducer connections and the transducer should be checked.

TRANSDUCER SHORTED. This message appears when the Propaq senses a short in the transducer. The transducer should be replaced.



CUFF Monitoring

tended Use

The Propaq noninvasive pressure channel measures arterial pressures using an inflatable cuff. If ECG or SpO_2 is also monitored, the Propaq synchronizes the cuff measurement process with the occurrences of the R-wave or systole, increasing accuracy in cases of extreme artifact. Although it is not necessary for accurate cuff measurements, it is recommended that you monitor ECG or SpO_2 when you use the cuff on patients exhibiting high artifact, diminished pulses, or some dysrhythmias.

WARNING

The Propaq should never be used to monitor NIBP on one patient while simultaneously monitoring ECG or SpO_2 on another patient.

The Propaq is intended for use only on pediatric and adult patients with a limb circumference of at least 18 cm for the limb on which the cuff is to be placed. The Propaq is not intended for use on neonate patients or any patient with a limb circumference less than 18 cm.

Blood pressure measurements determined with the Propaq are equivalent to those obtained by a trained observer using the cuff/stethoscope auscultation method, within the limits prescribed by the American National Standard for Electronic or Automated Sphygmomanometers.

The Propaq is designed to provide accurate arterial blood pressure readings. However, if any blood pressure measurement is suspect, another method of pressure measurement should be used to verify the Propaq's pressure readings. When auscultating to verify diastolic pressures, you should use the fifth phase of the Korotkoff sounds (that is, the point when the sound cannot be heard).

WARNING

Do not attempt to take CUFF pressures on patients during cardiopulmonary bypass.

Typical cuff measurements are completed within 30 seconds using the Propaq. If the Propaq cannot take a valid cuff measurement within three minutes, it automatically deflates. However, as with any measurement

device that impairs circulation, the patient's limb should be periodically observed to ensure that the circulation is not impaired for a prolonged period of time. The Propaq automatically deflates the cuff if cuff pressure exceeds 260 mmHg for any reason. A safety valve exists in the system to ensure that cuff pressure never exceeds 330 mmHg.

The Propaq uses the oscillometric method to determine blood pressure. Oscillometry directly detects mean arterial pressure values by (1) occluding a limb artery in stages and (2) monitoring small changes in the cuff's pressure caused by blood pulsing against the cuff pressure. The systolic and diastolic pressures are calculated from the mean pressure based on a patented, proprietary calculation determined by extensive research.

As with any manual or automatic auscultatory or oscillometric pressure measurement technique, the following can adversely affect accurate measurement determination:

- patients exhibiting cardiac arrhythmias, sudden changes in blood pressure, convulsions, shivering, or other body motion,
- hospital personnel or other non-stationary objects in contact with the cuff (changes in pressure caused by an object bumping against the cuff can result in erroneous or abortive readings).

?paration

You can set up the Propaq to take measurements manually (MANUAL), automatically at periodic intervals from one minute to 60 minutes (AUTO), or consecutively for a period of five minutes (TURBOCUF).

WARNING

When setting up the cuff channel, be sure that the cuff vent next to the cuff connector on the Propaq side panel is not obstructed. Obstructing this vent will prevent cuff measurements from occurring.

Setting up for noninvasive blood pressure monitoring requires three steps: place the cuff on the patient and connect the cuff to the monitor, set up the Cuff channel, and set the Cuff alarm limits.

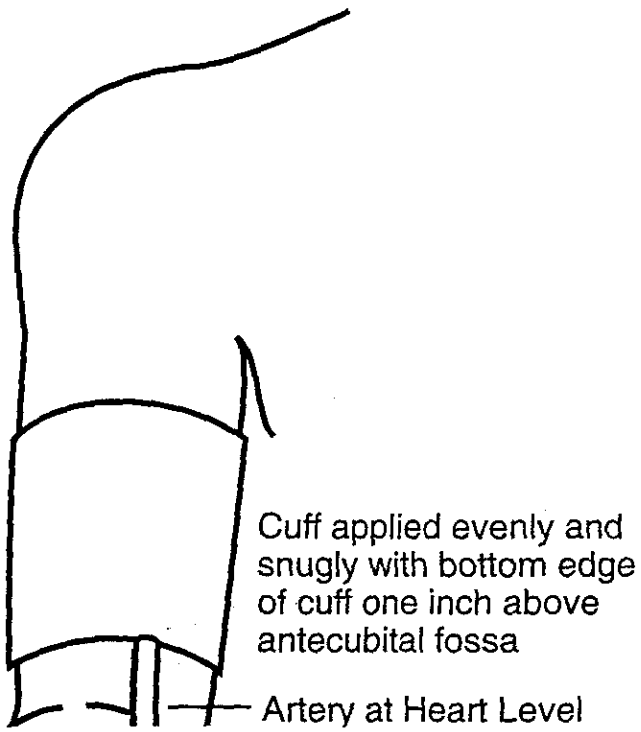
Placing the Cuff. Select the proper size of cuff based on the limb circumference from the following table. You can use an arm or leg (thigh) for noninvasive blood pressure measurements. Several different cuff sizes are available for taking measurements on limbs of differing sizes. An adult sized cuff for use on an arm is included with the Propaq at the time of purchase. However, other sizes are available from Protocol Systems. See Appendix C for information on ordering cuffs.

☞ Squeeze as much air from the cuff as you can before placing it on the patient.

Limb Circumference	Cuff Type
18 to 26 cm	Child
25 to 35 cm	Standard Adult
33 to 47 cm	Large Adult
46 to 66 cm	Thigh

☞ Place the cuff on the limb. If you are placing the cuff on an arm, it should be placed at the same level as the heart (see figure). Add 1.9 mmHg to the cuff measurement for every inch the cuff is above the heart level. If you are placing the cuff on a thigh, subtract 1.9 mmHg from the measurement for every inch the cuff is placed below the heart level. (If the cuff is on an arm and below heart level, you should also subtract 1.9 mmHg for every inch the cuff is below the heart level.) The cuff should fit snugly, but not be uncomfortable. The hose must not be kinked or pinched.

☞ Screw the hose connector, finger tight, onto the CUFF connector on the monitor's left side.

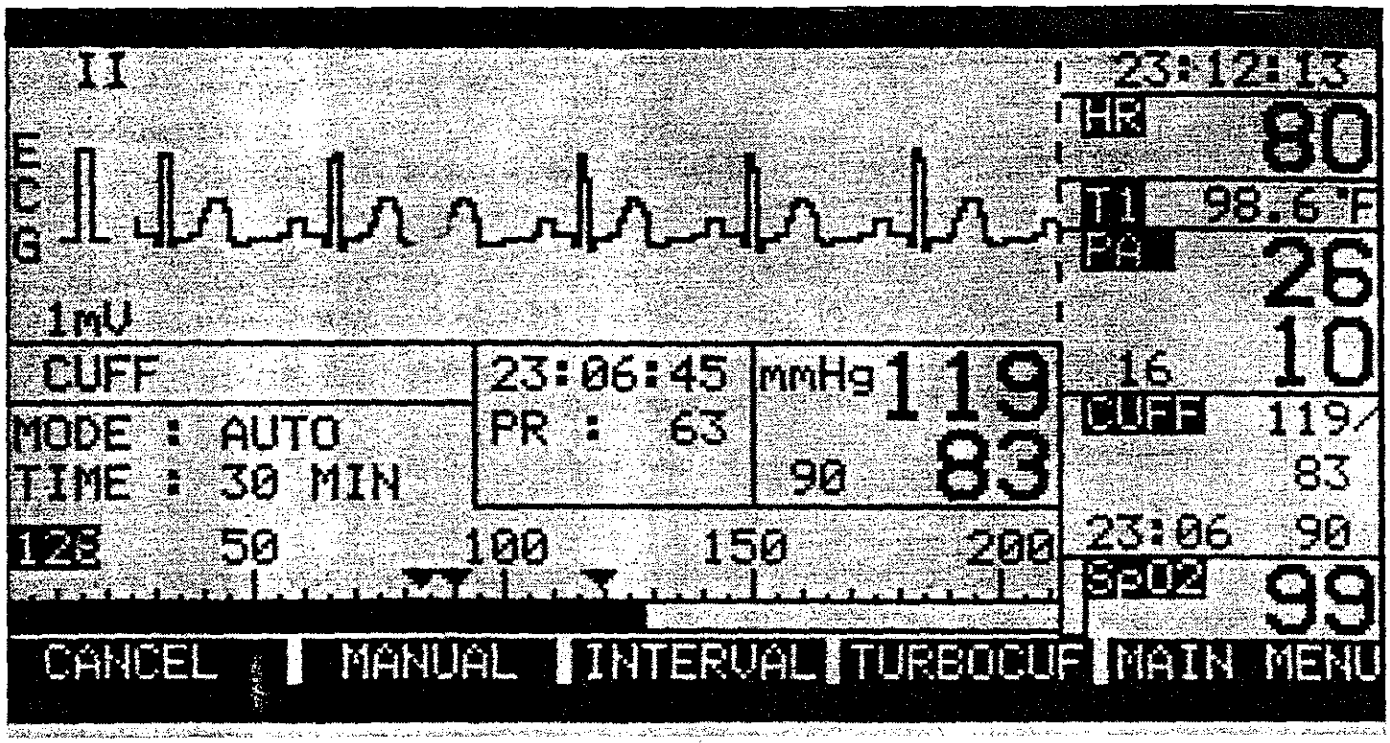


The cuff should be placed at the same level as the heart, if you place the cuff on an arm. If you place the cuff at a different level from the heart, for every inch the cuff is above the heart, add 1.9 mmHg to the displayed reading. For every inch the cuff is below the heart, subtract 1.9 mmHg from the displayed cuff reading.

☞ **Setting Up the Cuff Channel.** Press SENSORS and then CUFF to set the cuff functions. The following button labels appear in the Cuff Menu. The figure on the following page shows the cuff status window and the Cuff Menu. The cuff status window lets you view the progress of the cuff measurement as it is taken.

- **START**—always starts a blood pressure measurement, whether or not the Propaq is set to automatically take measurements. When you press START, the button label changes to CANCEL so you can cancel the measurement.
- **MANUAL**—turns off automatic interval measurements. The INTERVAL label changes to AUTO.
- **AUTO**—sets the Propaq to automatically initiate a noninvasive pressure measurement at intervals from one minute to 60 minutes. When you press AUTO, the button label changes to INTERVAL, and the first interval is shown on the display next to the word "TIME". Press the INTERVAL button to change the interval until the desired value is displayed. Any time the Propaq is taking a noninvasive pressure measurement, the START button changes to CANCEL so you can stop the measurement in progress. For more information about automatic measurements, see *Important Information About Automatic Measurements* below.
- **TURBOCUF**—automatically begins taking consecutive noninvasive pressure measurements for five minutes. As soon as one measurement is complete, the next one starts. After five minutes, measurements are stopped. Any measurement can be canceled by pressing the CANCEL button.

☞ **Setting the Cuff Alarms.** Set the alarm limits according to your hospital's protocols. See Chapter 3 for information on setting alarm limits.


II
ECG
1mV
23:12:13
HR 80
T1 98.6 °F
PA 26
10
16
CUFF 119/
83
23:06 90
SpO2 99
CUFF
MODE : AUTO
TIME : 30 MIN
23:06:45
PR : 63
mmHg 119
90 83
50 100 150 200
CANCEL
MANUAL
INTERVAL
TURBOCUF
MAIN MENU

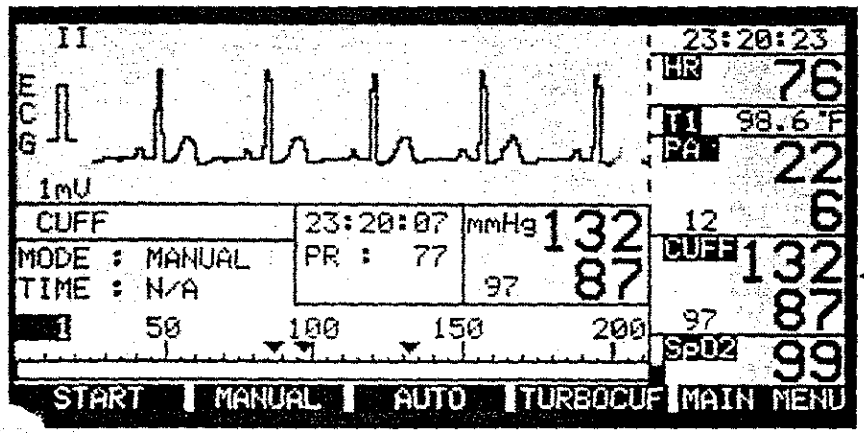
Hc. Cuff is Displayed

When you press SENSORS and then CUFF, the cuff status window and Cuff Menu appear (see figure on previous page). The cuff window displays all the following information:

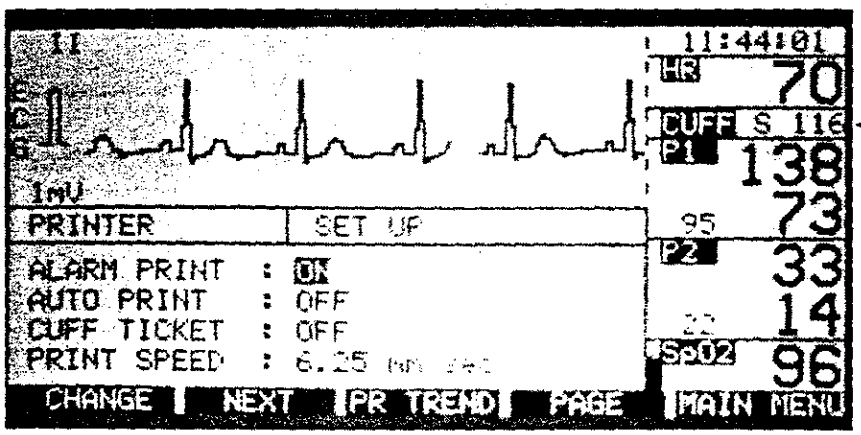
- whether the Propaq is set to take measurements automatically, manually, or using TURBOCUF
- if measurements are taken automatically, the measurement interval
- if TURBOCUF is activated, the time remaining to take measurements
- the current cuff pressure level with a manometer and a numeric value that changes as the cuff inflates and deflates
- the last blood pressure readings (systolic, diastolic, and mean values) shown as numerics and as small triangles above the manometer
- the pulse rate (PR) obtained from the cuff or from the ECG or SpO_2 channel if either is monitored
- the time the last pressure measurements were taken
- whether or not alarm limits are set for cuff (the bell symbol)

The cuff status window is displayed until you press MAIN MENU. If you press MAIN MENU during a cuff measurement, the measurement is not canceled.

After a measurement has been determined, if the cuff status window is not displayed, the noninvasive blood pressure values are displayed in a vacant blood pressure numerics window or below the heart rate in the temperature numerics window (see figure below). If temperature is being monitored, the noninvasive pressure's systolic, diastolic, and mean values are each displayed for about a second, circulating through the noninvasive values and the temperature values (see Chapter 1 for more information about this window).

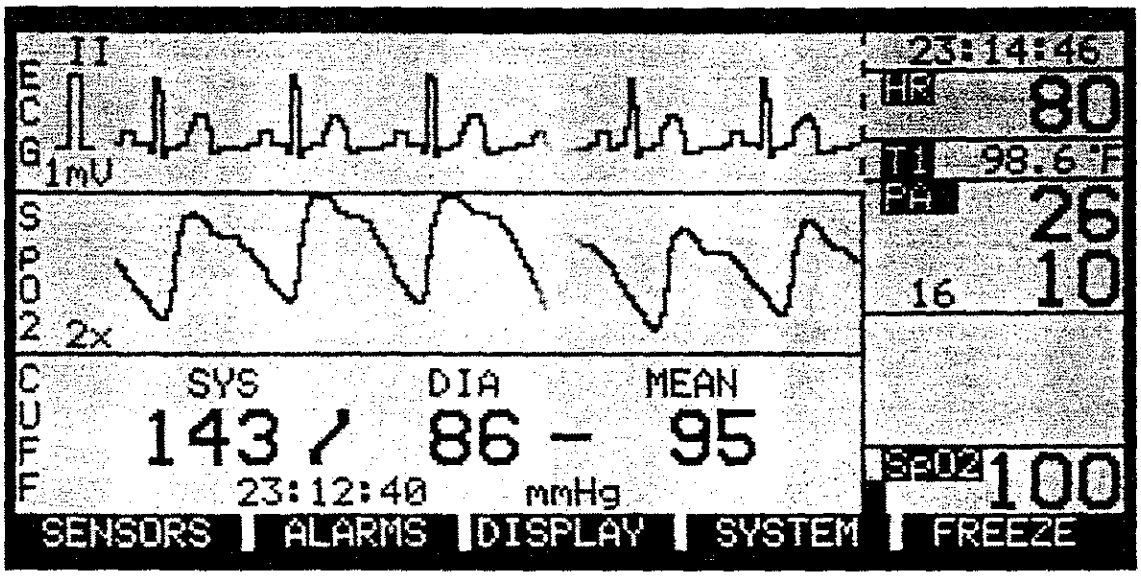


After a cuff measurement, the cuff reading will appear in a vacant blood pressure numerics window.

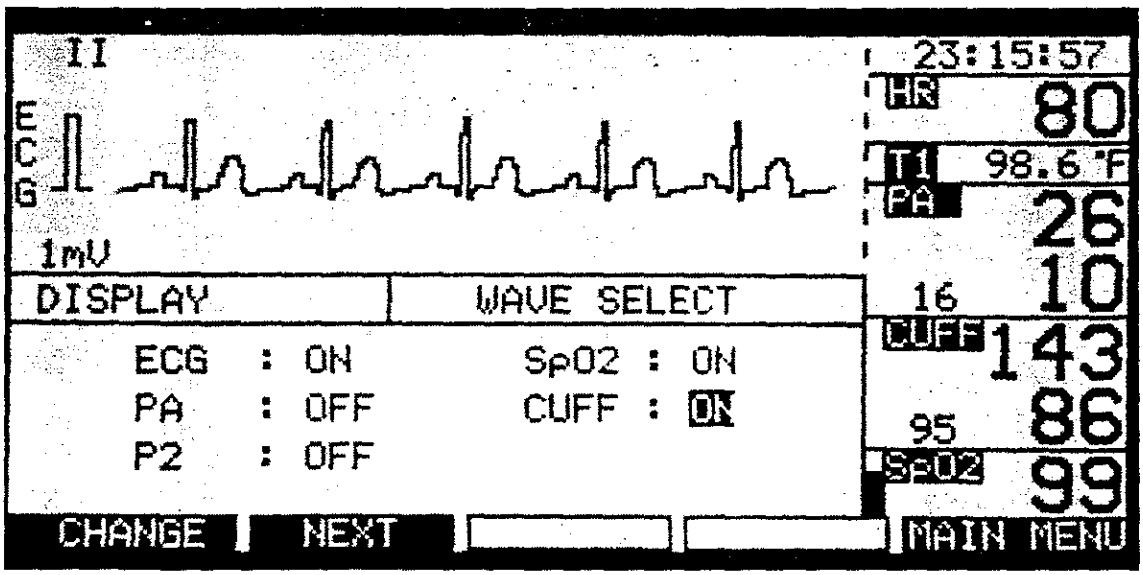


If both blood pressure numerics windows are occupied (Propaq 106 only), the cuff readings are displayed in the temperature numerics window.

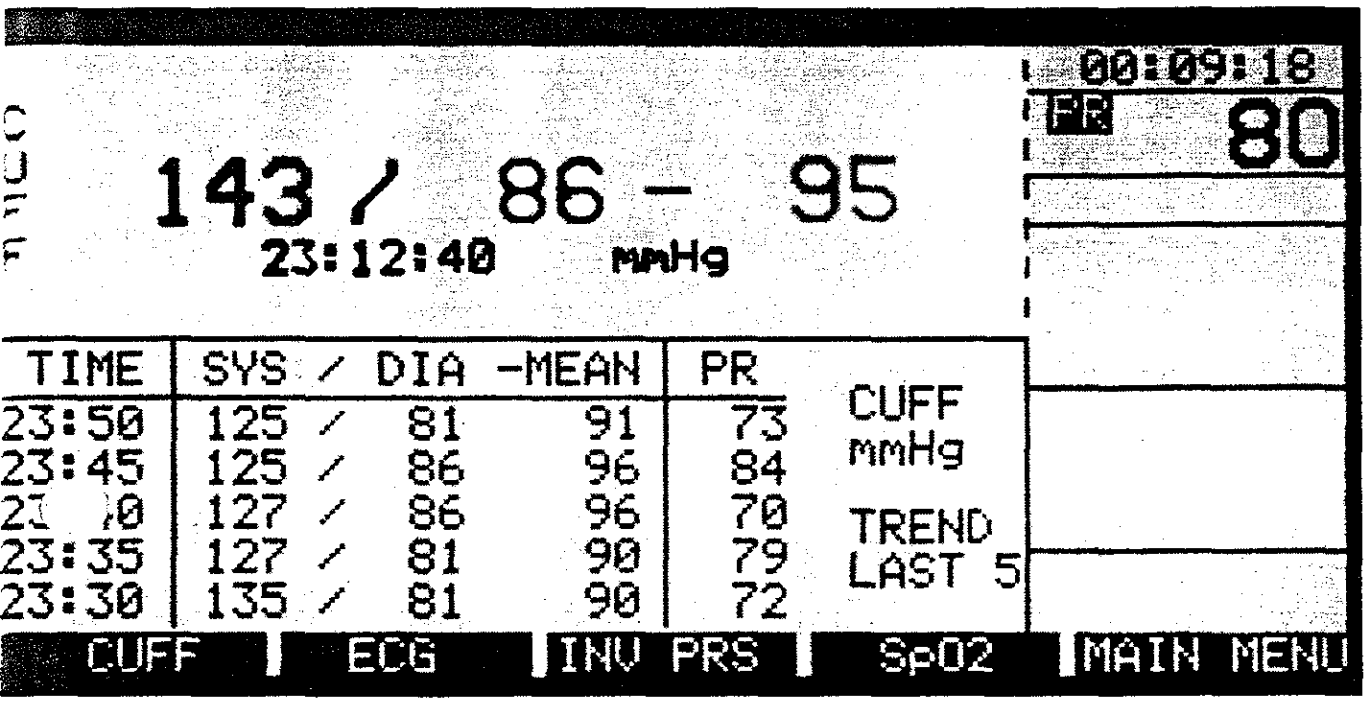
You can display the noninvasive pressure values like a waveform window by turning on CUFF in the wave select window and making sure that, including CUFF, only three windows are activated (see figure below). Besides CUFF, if more than two other windows are turned on and they are all being monitored, the CUFF numerics will not appear on the display in a waveform window.



When CUFF is turned on in the wave select window (below) and only two other monitored vital signs are also turned on, the cuff window is displayed like a waveform window.



If cuff is the only vital sign being monitored, the Propaq determines this and displays the cuff numerics in a waveform window above a trend window. The cuff numerics are displayed where ECG is normally shown.



mp ant Information About Automatic Measurements

When the selected interval is from 5 to 60 minutes, a blood pressure measurement will begin when the minute of the time of day clock is evenly divisible by the interval. For example, if the interval is set to 10 (minutes), measurements will begin at the hour and at 10, 20, 30, 40, and 50 minutes passed the hour.

When the selected interval is from 1 to 3 minutes, the monitor waits the selected time between the beginning of each measurement. Your results may vary if the measurement takes longer than 30 seconds, because the monitor requires that the cuff pressure be below 5 mmHg for a minimum of 30 seconds between measurements to give the subject's arm a chance to restore blood flow to the limb.

Printing Cuff Measurements

A special printer function allows you to print the results of a cuff measurement each time one occurs. The printout is called the Cuff Ticket (see figure below). The Cuff Ticket must be turned on in the Printer Setup window.

☞ To turn on CUFF TICKET, press SYSTEM, and then PRINTER. The printer setup window appears.

☞ Use the NEXT and CHANGE buttons to select and turn on the CUFF TICKET (see Chapter 1 for more information on setting up the printer).

TABULAR TREND 04/02/91

TIME	SYS / DIA - MEAN	HR/PR	SpO2
HH:MM	------mmHg------	BPM	%
06:00	113 / 61 - 73	57	99
05:45	100 / 55 - 66	53	99
05:30	133 / 59 - 72	61	98
05:15	114 / 71 - 85	63	98
05:00	111 / 61 - 73	56	98
04:45	125 / 62 - 77	56	98
04:30	102 / 54 - 62	82	98
04:15	95 / 53 - 60	64	99
04:00	115 / 59 - 72	62	98
03:45	100 / 51 - 61	62	98
03:30	98 / 52 - 66	59	99
03:15	119 / 68 - 83	61	98
03:00	92 / 49 - 61	59	98
02:45	107 / 49 - 66	61	98
02:30	85 / 41 - 49	60	98
02:15	119 / 61 - 77	65	99
02:00	108 / 52 - 66	65	98
01:45	110 / 54 - 67	57	98
01:30	102 / 54 - 66	58	99
01:15	115 / 57 - 67	57	99
00:45	120 / 68 - 83	64	98
00:30	115 / 59 - 72	64	98
00:15	108 / 57 - 66	63	98
00:00	121 / 60 - 73	62	99
23:45	125 / 62 - 77	66	99
23:15	124 / 63 - 72	57	98
23:00	120 / 60 - 72	61	98
22:45	116 / 59 - 73	61	99
22:31	99 / 55 - 66	73	99
22:15	104 / 70 - 78	98	98

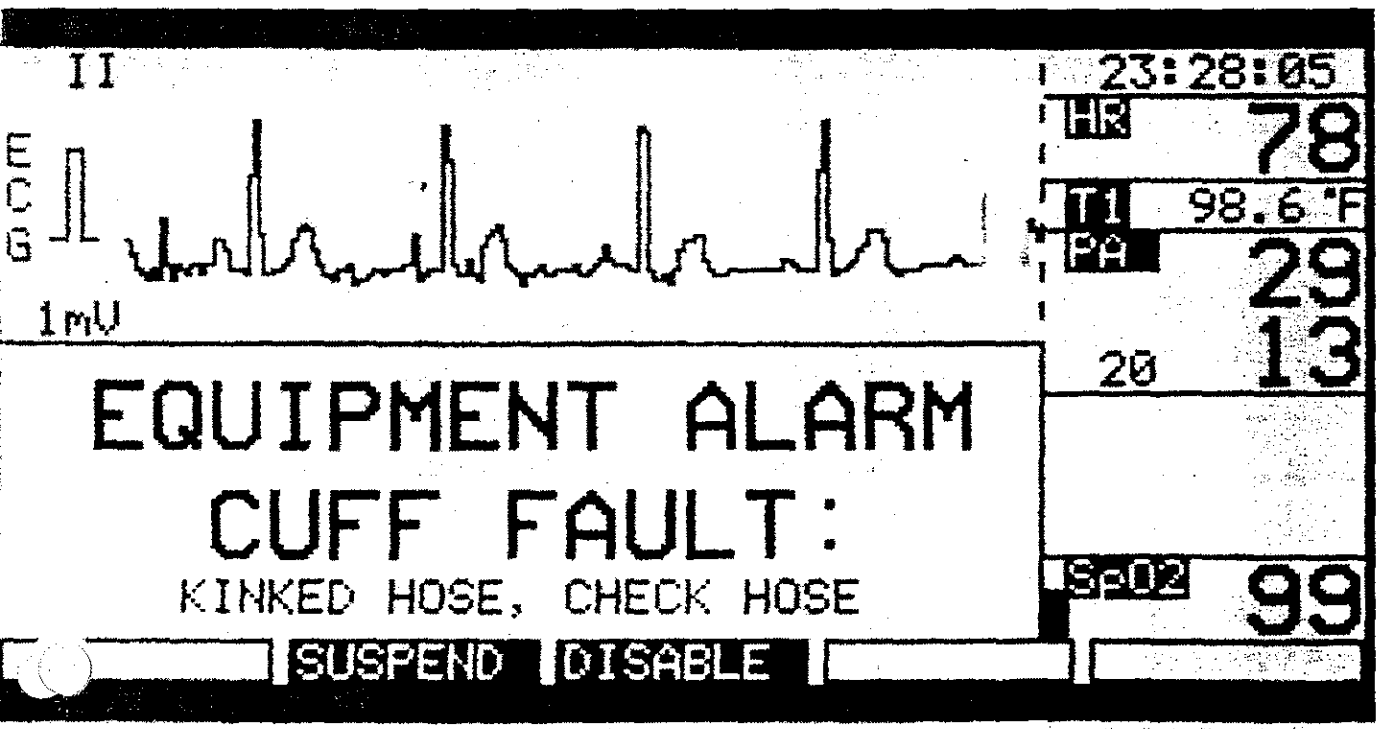
The Cuff Ticket provides useful documentation of each cuff measurement. Up to 128 measurements that are less than eight hours old can be printed as a tabular trend. See Chapter 4 for more information.

ʼu essages

The following cuff messages can appear in the ***equipment alarm window*** (an example is shown below). A CUFF FAULT caution message also appears in the time of day window above the heart rate.

CUFF FAULT: LOW BATTERY, CUFF DISABLED. The battery lacks sufficient voltage to be able to operate the CUFF channel. Connect the Propaq to the ac power adapter.

CUFF FAULT: CALIBRATION ERROR, CUFF DISABLED. The Propaq continually recalibrates the CUFF channel to ensure it can properly make cuff determinations. If this message momentarily appears and then is removed, the CUFF channel was able to calibrate itself and the cuff channel is properly operating. If this message continuously appears, the cuff channel could not be properly calibrated and must be disabled using the DISABLE button. Once the cuff channel is disabled, normal monitor operation continues, but the cuff channel cannot be used. Have the monitor serviced.



CUFF FAULT: MEASUREMENT TIME OUT. A valid cuff measurement could not be determined within 3 minutes. This could be due to patient motion, arrhythmia, or other environmental influences such as transport vibration. Try the measurement again.

CUFF FAULT: EXCESSIVE ARTIFACT. Too much patient motion, patient arrhythmia, or sources of external cuff movement can cause this message.

CUFF FAULT: NO PULSES DETECTED. The cuff may not be on a patient or properly applied to the patient.

CUFF FAULT: CUFF NOT DETECTED. During cuff inflation the detected pressure did not sufficiently rise. Check that the cuff connection is tight and take the measurement again.

CUFF FAULT: VALID BLOOD PRESSURE NOT FOUND. The Propaq cannot process the measurement data it acquired. Patient motion, arrhythmia, or outside environmental influences such as transport vibration can cause this message.

CUFF FAULT: KINKED HOSE, CHECK HOSE. The Propaq could not properly inflate the cuff. Check for a kinked hose between the monitor and the patient.

CUFF FAULT: BLOCKED VENT. The pressure in the cuff cannot be vented to the atmosphere. Inspect the vent hole for blockage.

CUFF FAULT: AIR LEAK, CHECK HOSE. The Propaq could not properly inflate the cuff. Check the hose and cuff for obvious leaks, such as the O-rings in the hose connections.

CUFF FAULT: CAUTION! SOME ARTIFACT PRESENT. This message will appear if the Propaq detects some artifact, but the blood pressure measurement can still be determined.

CUFF FAULT: WEAK PULSES, CAN'T FIND SYS/DIAS. There are not enough pulses to determine the systolic or diastolic pressures, but a mean pressure is available. Take another measurement.

The following messages can appear in the ***cuff status window.***

CALIBRATING. The CUFF channel is running an internal calibration.

DISABLED, CAL ERROR. See the description above for CUFF FAULT: CALIBRATION ERROR, CUFF DISABLED.

DISABLED, LOW BATT. See the description above for CUFF FAULT: LOW BATTERY, CUFF DISABLED.

,emperature Monitoring

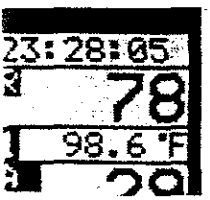
ntended Use

Propaq monitors provide either two temperature channels (Models 102 & 104) or one temperature channel (Model 106). When two channels are active, the difference temperature (ΔT) is also displayed. You can select in which units, °C or °F, temperature is shown to match your hospital's protocols.

The Propaq is intended to be used with Yellow Springs Instrument Co.'s (YSI) Models 400 and 700 Series temperature probes, or other manufacturer's models that are equivalent. You can also use Electromedics 2100, 2400, and 2700 series probes. Other temperature probes that do not match the performance specifications of these probes may produce erroneous temperature readings.

You can use several different types of probes, including esophageal, rectal, needle, and skin probes.

'reparation



Monitoring temperature with the Propaq requires you to place the probe on the patient and connect it to the Propaq, select the temperature units, and set the temperature alarm limits.

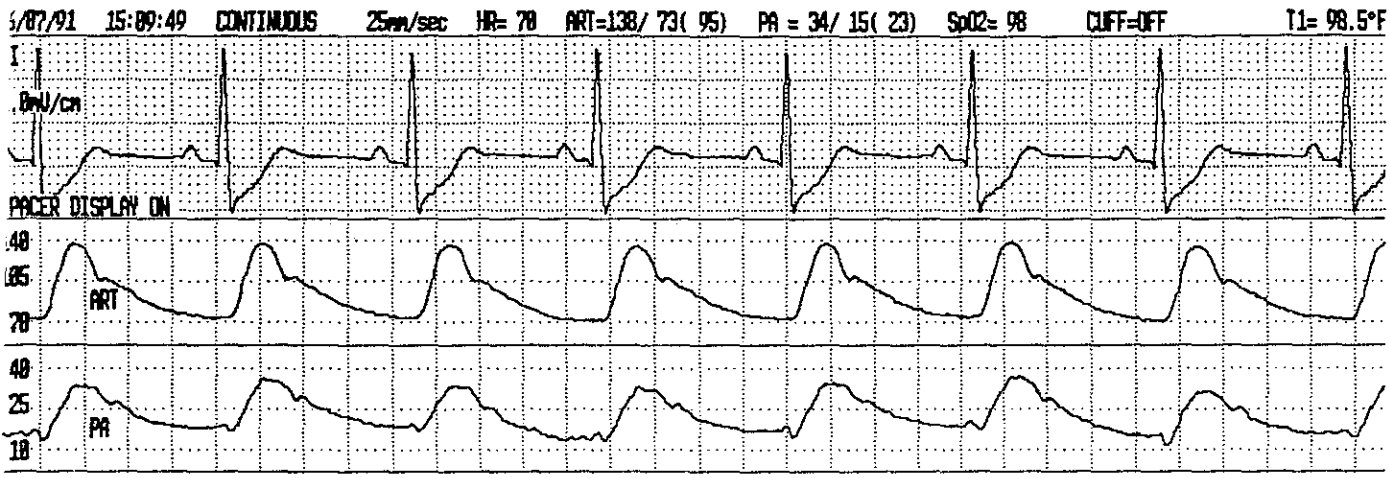
☞ Once you have selected the temperature probe(s) you want to use, place the probe on the patient and plug it into one of the connectors on the Propaq's side panel. Within a few seconds, the Propaq will display the temperature below the heart rate.

☞ To select the temperature units (°C or °F), press DISPLAY, then MORE, then MORE again, and then TEMP F/C. The Propaq automatically updates the temperature display to show the newly selected units.

☞ Set the alarm limits according to your hospital's protocols. See Chapter 3 for information on setting alarm limits.

Printing Temperature

Temperature is a non-waveform vital sign. All monitored temperature values are printed along the top of each printout in the numerics (see figure below).



Temperature Messages

The following messages can appear in an equipment alarm window. A temperature caution message will also appear in the time of day window when one of these messages appears.

PROBE NOT DETECTED. This message occurs when the Propaq has successfully measured temperature and a probe is disconnected. Reconnect the probe, suspend the equipment alarm, or disable the channel using the DISABLE button.

PROBE SHORT OR OUT OF RANGE. This message usually indicates a probe problem. However, the temperature being measured may be beyond the range of the probe. If the probe is correctly applied to a patient who you suspect to have a measurable temperature, replace the probe.

ulse Oximetry Monitoring (SpO_2)

ntended Use

The Propaq's Pulse Oximetry (SpO_2) patient channel noninvasively measures oxygen saturation of *functional arteriolar hemoglobin* at a peripheral measurement site, such as a finger, toe, or the bridge of the nose. SpO_2 is the most recent standard term assigned to measuring oxygen saturation using a pulse oximeter as opposed to an arterial blood sample (SaO_2).

The Propaq Pulse Oximetry option is intended for use only as an adjunct in patient assessment. As with any pulse oximeter, the Propaq Pulse Oximetry option must be used in conjunction with patient signs and symptoms. Oxygen saturation measurements using pulse oximetry are highly dependent on proper placement of the sensor and patient conditions. Conditions such as shivering may cause artifact, resulting in erroneous oxygen saturation readings. Patient conditions, such as smoke inhalation, can cause pulse oximetry measurements to be suspect. If pulse oximetry measurements are suspect, verify the reading using another clinically accepted measurement method, such as arterial blood gas measurements.

The Propaq Pulse Oximetry option has been designed to match the performance of a NELLCOR N-200 Pulse Oximeter. The Propaq Pulse Oximetry option is intended for use on adult and pediatric patients using only NELLCOR oxygen transducers (sensors). *The Propaq Pulse Oximetry option is not intended for use on neonatal patients.*

Only NELLCOR oxygen transducers, including OXISENSOR patient-dedicated adhesive sensors, should be used with the Propaq Pulse Oximetry option. See SpO_2 Sensors below for a list of compatible sensors and for more important information about sensors and sensor cables, including the NELLCOR Patient Module Cable.

The Propaq SpO_2 channel is self-calibrating, assuring accurate measurements. Self-calibration is performed when the monitor is first turned on, at least every 15 minutes thereafter (sometimes sooner if the channel detects it is needed), and whenever a sensor is connected to the channel.

Fractional and Functional Saturation

Measurements may differ between medical instruments measuring *fractional* and *functional* oxygen saturation.

Fractional oxygen saturation is defined as oxygenated hemoglobin expressed as a percentage of all hemoglobin that is measured, whether or not the hemoglobin is available for oxygenation (this includes dysfunctional hemoglobins, such as carboxyhemoglobin and methemoglobin). The Propaq SpO_2 channel does not measure dysfunctional hemoglobins.

Functional oxygen saturation is defined as oxygenated hemoglobin expressed as a percentage of the hemoglobin that is capable of transporting oxygen. The Propaq SpO_2 channel detects only oxygenated and deoxygenated hemoglobin, resulting in a *functional* hemoglobin measurement.

Functional oxygen saturation is determined from the pulsatile arteriolar component of blood using two different wavelengths of light. The absorption and reflection characteristics of hemoglobin allow the saturation level to be determined noninvasively.

Saturation/Heart Tone

One of the most unique aspects of the Propaq Pulse Oximetry option is the audible heart tone indicating changes in the measured oxygen saturation level. When SpO_2 is being measured, the heart tone is produced using a special speaker in the Pulse Oximetry module. As the oxygen saturation increases and decreases, the pitch of the heart tone rises and falls. This provides immediate recognition of saturation changes. If SpO_2 is not being monitored, the heart tone is produced by the Propaq's speaker.

Measurement Range

The measurable range of saturation depends on the sensor used for measurement, but the Propaq Pulse Oximetry option can display from 0 to 100 percent saturation on both adult and pediatric patients.

NOTE

The Propaq Pulse Oximetry option is not intended for use on neonatal patients.

SpO_2 Sensors

The Propaq Pulse Oximetry option has been designed to operate with a wide range of NELLCOR, Incorporated oxygen transducers. The table below lists the NELLCOR accessories and sensors that can be used with the Propaq Pulse Oximetry option. These sensors have no heat source to burn a patient, and NELLCOR sensors are accurately calibrated at the factory.

Only NELLCOR oxygen transducers, including OXISENSOR patient-dedicated adhesive sensors, should be used with the Propaq Pulse Oximetry option.

The unique design of the Propaq Pulse Oximetry channel allows you to use a NELLCOR Patient Module Cable, a sensor extension cable, or to directly plug the sensor into the connector on the Pulse Oximetry module's side panel. The monitor detects whether the Patient Cable, or the extender or sensor cable is plugged in and uses the appropriate cable for sensing. Both cables cannot be plugged in at the same time.

Directly plugging the sensor or the extender cable into the Pulse Oximetry option side panel reduces the SpO_2 measurement value by one percentage point. For example, a 94% SpO_2 measurement acquired using a Patient Module Cable would appear as 93% if the sensor were directly connected to the Propaq or through an extension cable.

Model	Description
DS-100A	DURASENSOR Adult Digit Oxygen Transducer.
D-25	OXISENSOR Adult Digit Oxygen Transducer.
D-25L	OXISENSOR Adult Digit Oxygen Transducer
D-20	OXISENSOR Pediatric Digit Oxygen Transducer
R-15	OXISENSOR Adult Nasal Oxygen Transducer
EC-4	NELLCOR Sensor Extension Cable (4 ft.)
C-13-200	NELLCOR N-200 Patient Module Cable (13 ft.)
C-20-200	NELLCOR N-200 Patient Module Cable (20 ft.)

NELLCOR's DURASENSOR® is a reusable oxygen transducer supplied in a non-sterile package. Its optical components are mounted in a plastic casing. OXISENSOR™ oxygen transducers are sterile adhesive sensors. Their optical components are mounted in medical-grade adhesive tape.

Each sensor is designed for application to a specific site on a patient within a certain size range. To select the appropriate sensor, consider the patient's weight and which sensor application sites are available, as well as the adequacy of the patient's perfusion, the level of patient activity, whether sterility is required, and the anticipated duration of monitoring.

To ensure optimal performance, use an appropriate sensor, apply it as described in the sensor's *Directions for Use*, keep the sensor site at the level of the patient's heart, and always observe all warnings and cautions noted in the sensor's *Directions for Use.*

The sensors are sensitive to light. If excessive ambient light is present, cover the sensor site with opaque material to block the light. Failure to do so may result in inaccurate measurements. Light sources that can affect performance include surgical lights (especially those with a xenon light source), bilirubin lamps, fluorescent lights, infrared heating lamps, and direct sunlight.

If poor patient perfusion affects instrument performance and the patient weighs more than 50 kg, consider using the OXISENSOR R-15 adult nasal oxygen transducer. Because the R-15 obtains its measurements from an artery supplied by the internal carotid (the nasal septal anterior ethmoid artery) this sensor can obtain measurements when peripheral perfusion is relatively poor.

If patient movement presents a problem, consider the following possible solutions:

- be sure the sensor is secure and properly applied
- apply ECG electrodes and turn on C-LOCK (see below)
- use a new sensor with fresh adhesive backing
- move the sensor to a less active site
- use a type of sensor that tolerates some patient motion, such as the D-25, D-20, or R-15
- set the RESPONSE mode to SLOW

Preparation

Setting up the SpO_2 channel requires three steps: placing the sensor on the patient, set up the monitor for SpO_2 measurements, and set the SpO_2 alarm limits.

SpO_2 and Cuff Measurements

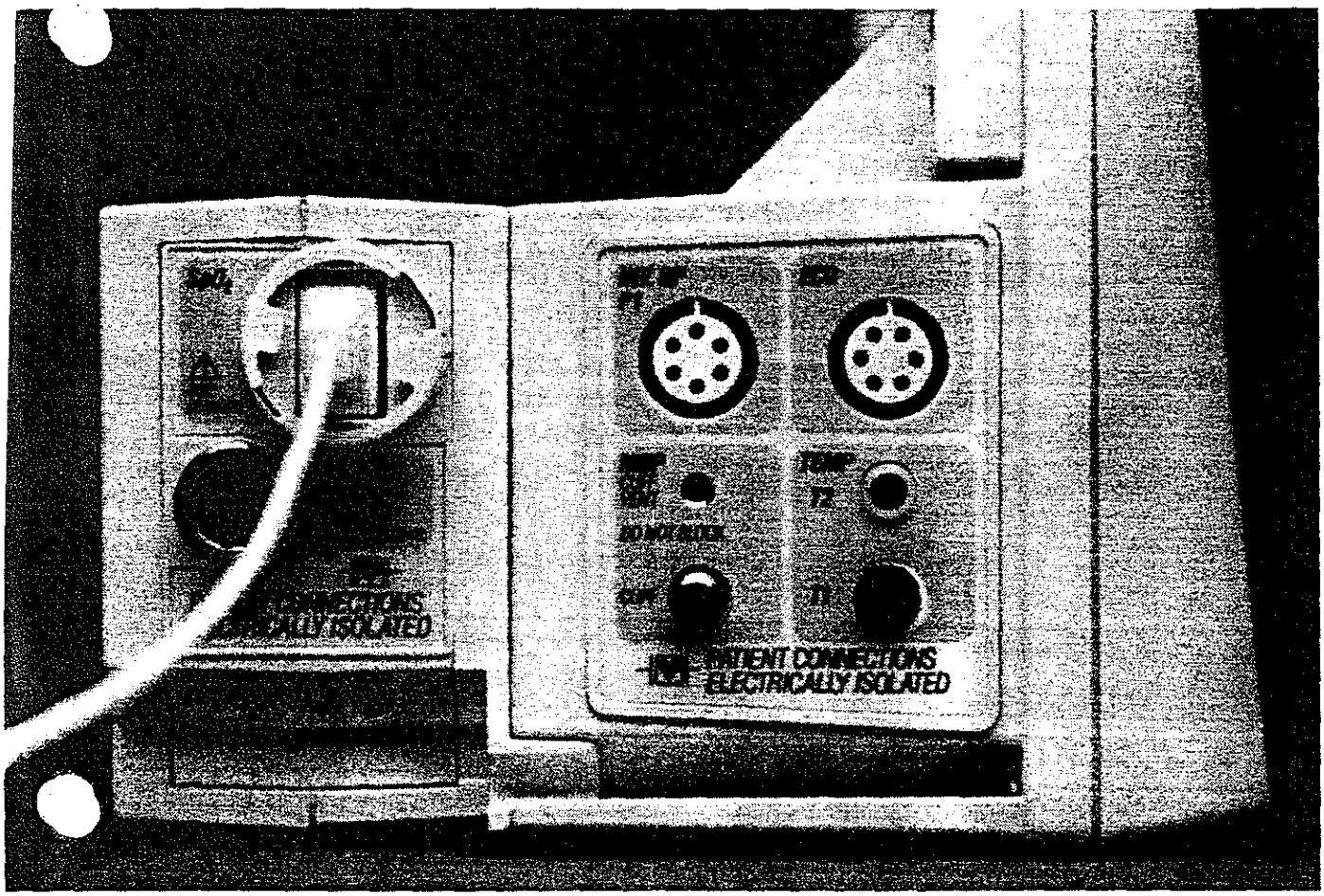
Special considerations are necessary when applying the oxygen sensor to the same limb used for cuff measurements. When placing the sensor on the patient, the sensor may be placed on the same limb as the cuff. If the SpO_2 sensor and cuff are on the same limb, blood circulation to the pulse oximetry measurement site is temporarily impaired while the cuff occludes the limb artery during blood pressure measurements. This affects SpO_2 measurements and could create an SpO_2 patient alarm if limits are set for SpO_2. It is recommended that you place the SpO_2 sensor on a limb that is not used to obtain cuff measurements.

☞ **Placing the Sensor.** Attach the sensor to the patient according to the instructions provided with the sensor. *Be sure to read all warnings and cautions provided in the sensor's* Directions for Use. *Sensor placement is extremely important.*

☞ **Setting Up the Monitor for SpO_2.** Plug the sensor into the SpO_2 sensor extension cable, NELLCOR Patient Module Cable, or directly into the monitor's side panel.

☞ Plug the cable into the Propaq. If you use the extension cable or plug the sensor directly into the Propaq, be sure to lock the connector by turning the locking ring (see the figure on the following page).

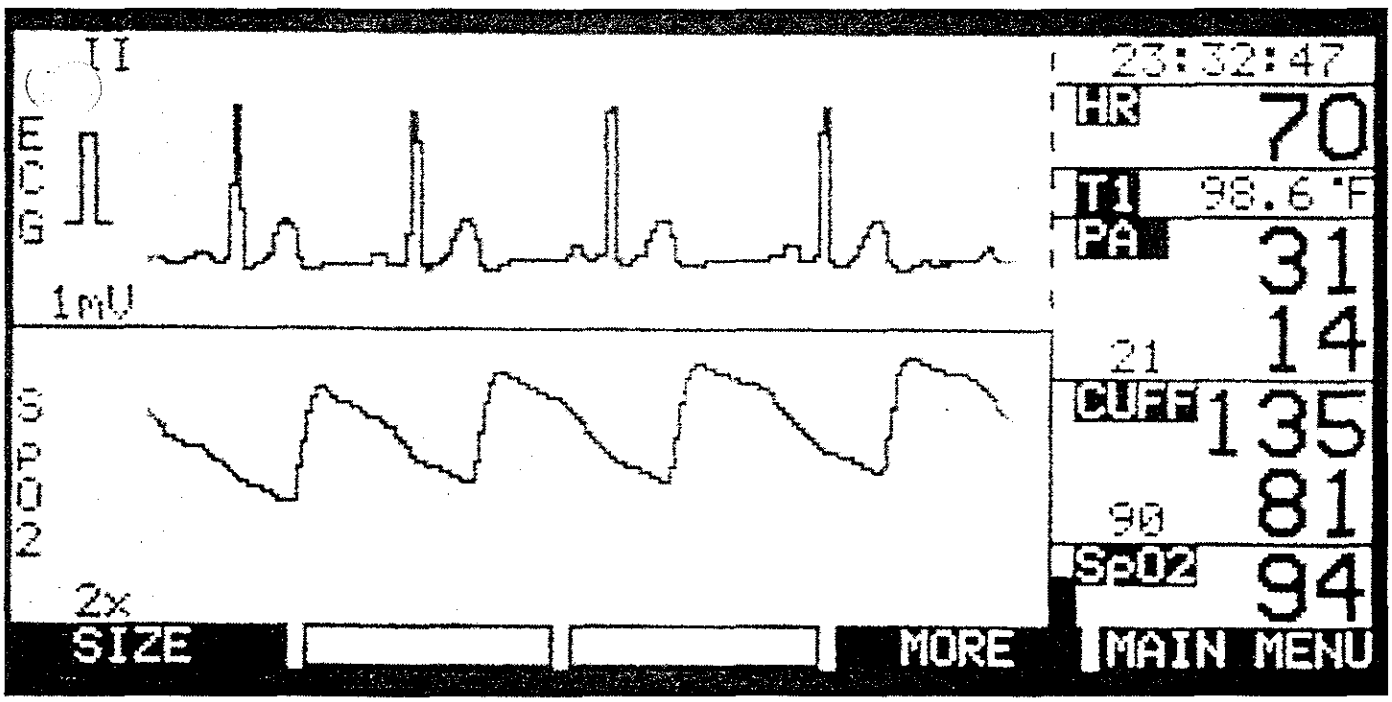
☞ When the sensor is connected to the monitor, the SpO_2 channel performs a self-calibration to assure measurement accuracy. SEARCH is displayed in the SpO_2 numeric window while the channel tries to detect blood pulsing through the measurement site. Once the measurement has been established, the saturation value is displayed in the numeric window.



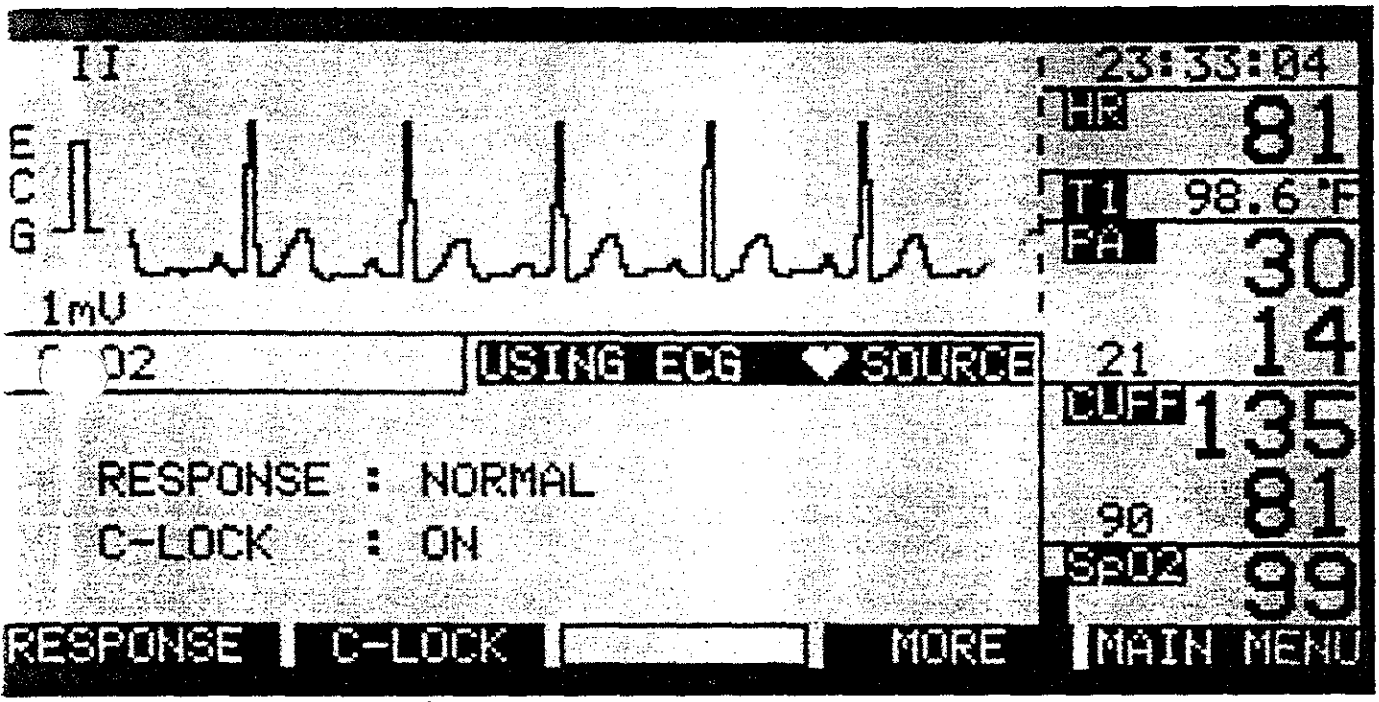
Proper application of the sensor and connection to the Propaq ensures accurate SpO_2 measurements. If you connect the sensor directly to the Propaq or use an extender cable directly connected to the Propaq, the displayed reading is one percentage point lower than the actual reading.

☞ From the Main Menu, press SENSORS, then SpO_2, and then SIZE to adjust the size of the waveform for best viewing. There are several waveform sizes to choose from. (If the waveform is to be viewed all the time, you will need to turn on the SpO_2 waveform in the wave select window. You may also have to turn off other waveforms to continuously display the SpO_2 waveform.)

☞ If necessary, adjust the placement of the sensor until a good SpO_2 waveform is displayed (see figure below). The waveform indicates the quality of the oxygen saturation measurement. A waveform with artifact may indicate erroneous oxygen saturation readings. Turn on the C-LOCK function as described below if you are also monitoring ECG. *If the measurement is suspect, use another clinically accepted method of determining oxygen saturation.*



☞ Press MORE to display other SpO_2 functions. When you press MORE, the SpO_2 waveform is removed, and the SpO_2 status window appears showing the current settings of RESPONSE and C-LOCK (see figure below). RESPONSE sets the time the Propaq Pulse Oximeter takes to acquire the oxygen saturation value. Three averaging times are available as described below. C-LOCK® is a NELLCOR patented function that allows the Propaq Pulse Oximetry option to more accurately make oxygen saturation measurements as described below.



☞ Press the RESPONSE button to select the desired response time according to the following guidelines.

Response	Time	*Indications for Use*
NORMAL	≈7 seconds	Relatively stable patients.
SLOW	≈15 seconds	Patients exhibiting movement preventing accurate measurement at NORMAL setting.
FAST	≈3 seconds	Special studies requiring fast readings (such as sleep studies) and where patient movement and other artifacts are not present.

☞ Press the C-LOCK button to activate (C-LOCK ON) or deactivate (C-LOCK OFF) this function. With C-LOCK turned on, the saturation measurements are determined with each R-wave detected by the ECG signal. Systole is the basis of proper SpO_2 measurement. The Propaq Pulse Oximetry option recognizes systole as the highest pulse signal from the oxygen sensor. Artifact-induced pulses caused by patient movement and other conditions could be recognized as systole. Synchronizing the pulse oximeter's systole determination with the ECG R-wave reduces the effects artifact may have on SpO_2 measurements. C-LOCK should be turned ON to accurately determine SpO_2 on patients with movement or where other artifact affects the SpO_2 measurement.

NOTE

When FAST response is selected, C-LOCK is inhibited, however, it is not turned off. C-LOCK is automatically uninhibited if response is set to other than the FAST setting.

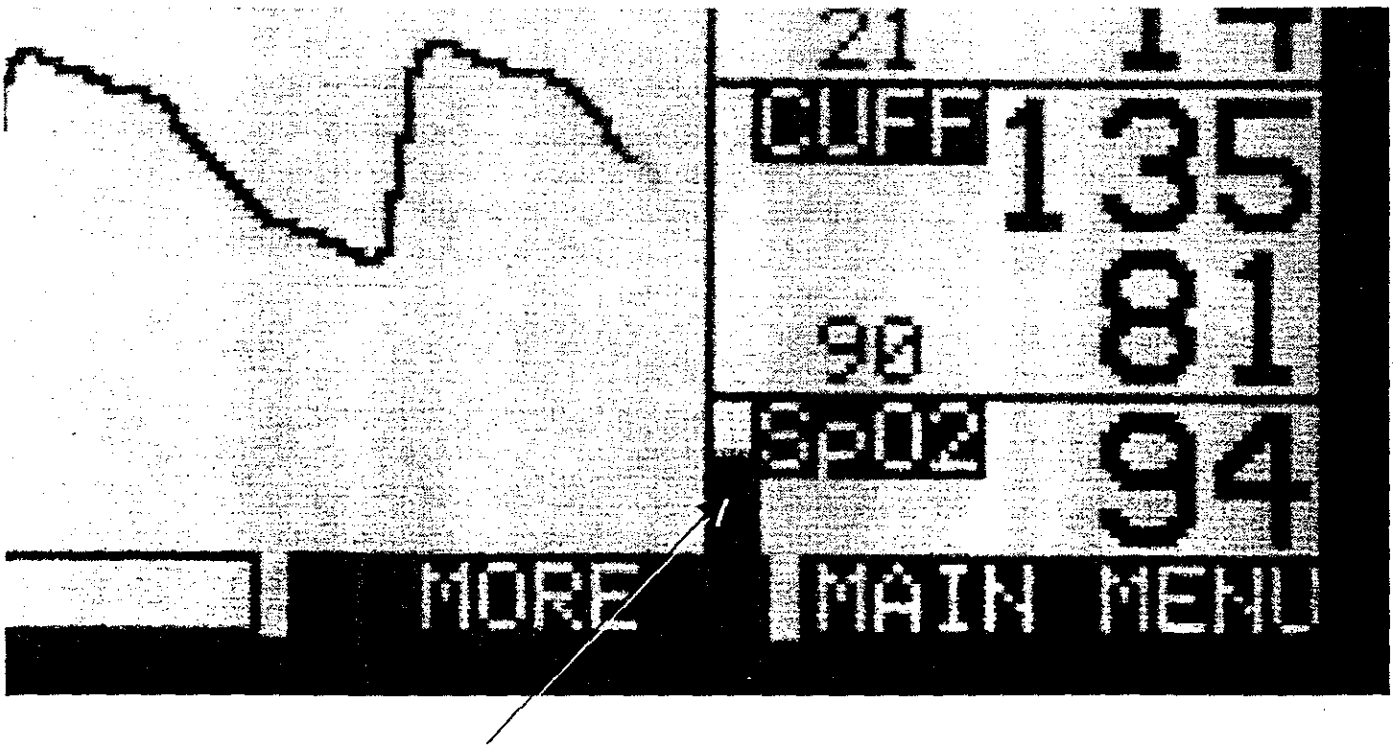
If C-LOCK is on, the heart rate source is automatically set to ECG. An ECG signal must be present or C-LOCK does not activate. If C-LOCK is on and the ECG signal is disrupted due to a lead failure, a C-LOCK caution message alternates with the time of day until the ECG signal is again received.

☞ **Setting the SpO_2 Alarms.** Set the alarm limits according to your hospital's protocols. See Chapter 3 for information on setting alarm limits.

low SpO_2 is Displayed

The Propaq Pulse Oximetry option displays a plethysmograph derived from the oxygen sensor, the oxygen saturation value as a percentage, and a pulse amplitude indicator that shows the relative change in the pulsatile signal coming from the measurement site (see figure below). The pulse amplitude indicator is helpful when the plethysmograph is not shown because other waveforms or a status window is displayed.

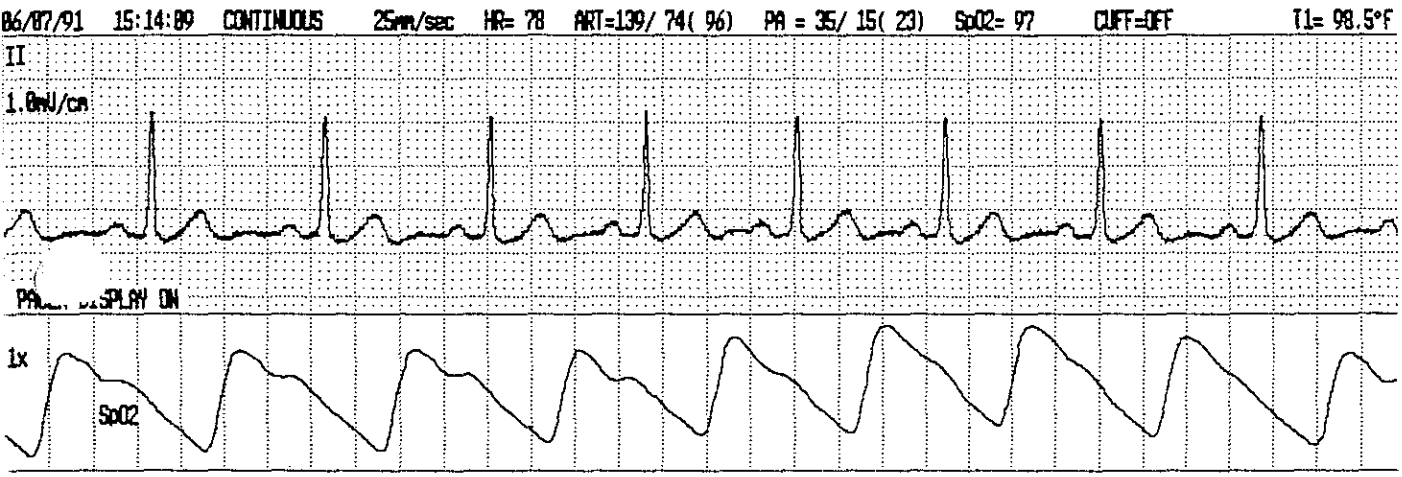
If the heart rate source is set to SpO_2, the pulses from the Propaq Pulse Oximetry option are counted to determine the pulse rate. The pulse rate measurement is displayed in the heart rate window. SpO_2 data is trended similarly to other patient data.

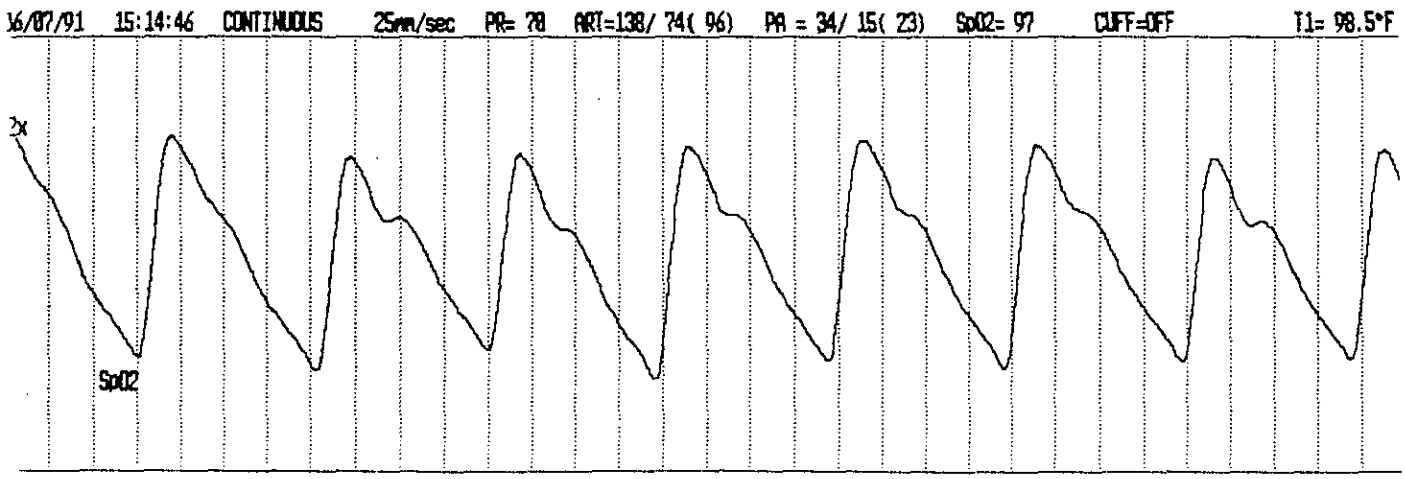


Pulse Amplitude Indicator

F ing the SpO_2 Plethysmograph

You can print the SpO_2 plethysmograph by pressing either the SNAPSHOT or START/STOP button on the printer when the waveform is displayed on the monitor. The plethysmograph is printed without a grid, and the size is printed at the beginning of the printout and every eight seconds afterwards (see figure below). If only SpO_2 is monitored or displayed, the waveform is printed by itself across the paper. Waveforms are always printed at the print speed selected in the Printer Menu (see Chapter 1). (The display speed does not affect the printer speed.) The oxygen saturation value is printed along with other patient vital sign numerics along the top of the paper.





SpO_2 Messages

SpO_2 messages can appear in the equipment alarm window (SpO_2 equipment alarms), the SpO_2 numeric window, or alternate with the time of day (SpO_2 caution messages).

NO SENSOR OR TWO SENSORS DETECTED appears in the equipment alarm window and can indicate one of the following:

- a probe has been disconnected from the monitor after being plugged in for a few seconds
- both a directly connected sensor cable and a NELLCOR Patient Module Cable are plugged into the SpO_2 side panel

Pressing DISABLE deactivates the alarm, removes the SpO_2 plethysmograph, and deactivates the channel.

If an SpO_2 sensor is subsequently connected to the Propaq, the channel becomes active and performs its self-calibration.

SEARCH is displayed in the numeric window after the Pulse Oximetry sensor is first connected to the monitor. During this search time, the SpO_2 channel tries to detect blood pulsing through the measurement site. Once the measurement has been established, the oxygen saturation value is displayed in the numeric window.

SpO2 SRCH alternates with the time of day whenever the channel cannot detect a pulse for SpO_2 measurements after it has successfully measured oxygen saturation. While this message is displayed, ??? is displayed in the numerics window and the SpO_2 channel searches for blood pulses at the sensor site.